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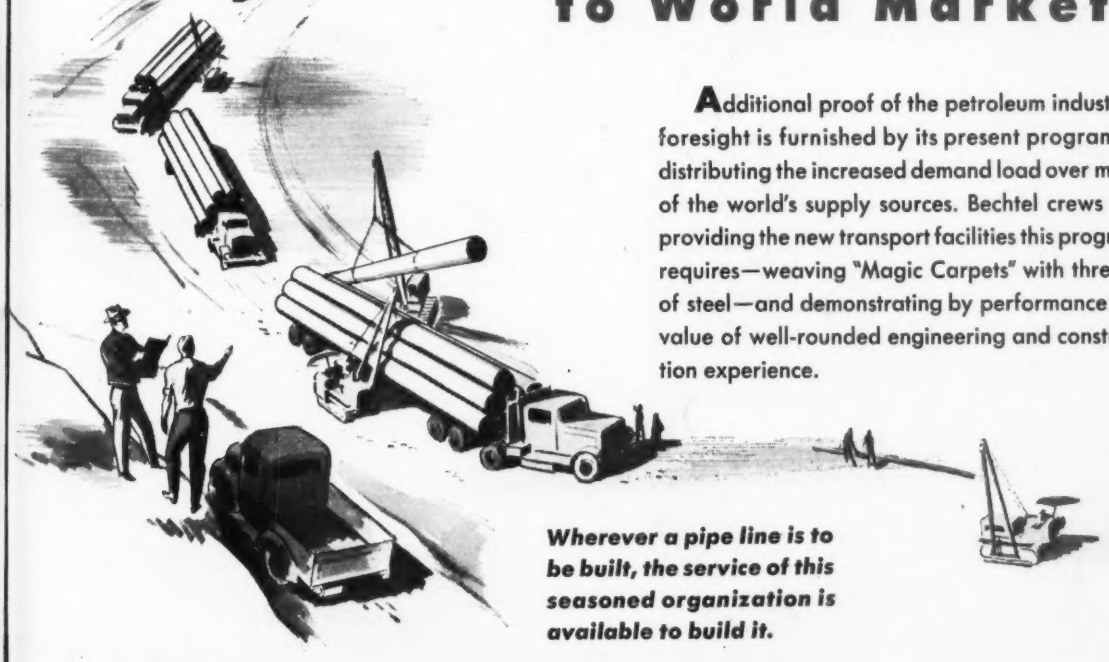

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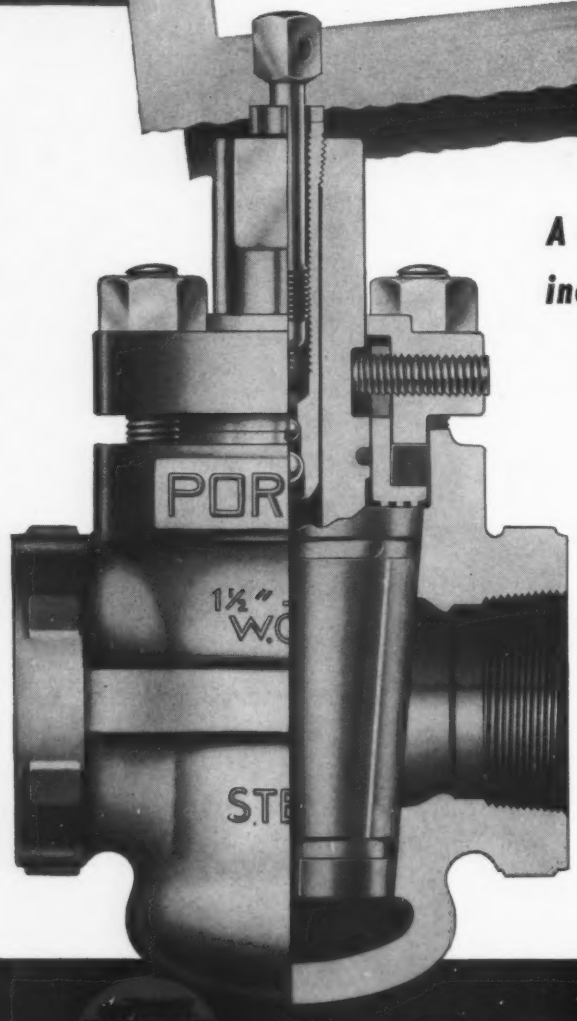
Lubricated
PLUG VALVES



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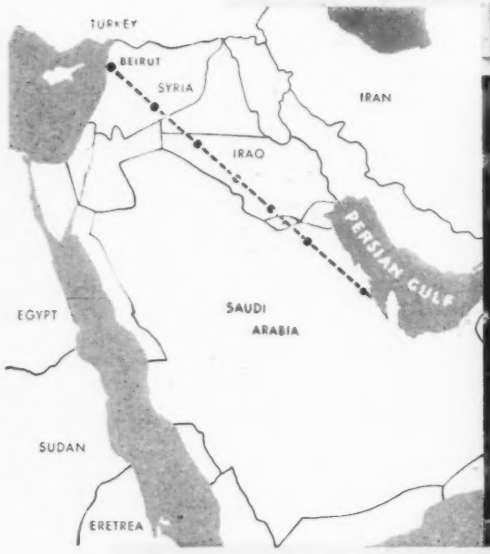
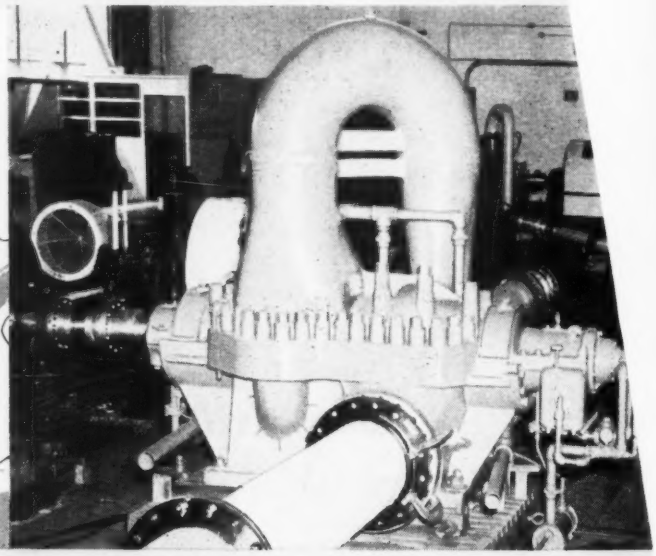


The world's largest pipe line pumps (in flowrate 400,000 bbls. per day and power 6500 hp ea.) are for the first station of the Trans-Arabian pipe line. The pumps are 14 x 16 BJ two-stage steam turbine-driven pipe line pumps.



Primary pumping station is located at the Persian Gulf end. Five booster stations, each equipped with five diesel-powered BJ single-stage pipe line pumps, are located at 175-mile intervals along the 1050-mile line.

THE CAPACITY of this line is more than 50 percent greater than the famous Big Inch. Such record-breaking units as these are only a part of BJ's production of oil line pumps. On your next pipe line, take advantage of the engineering experience Byron Jackson Co. has gained in building highly efficient centrifugal pipe line pumps for any capacity and head, from the smallest to the largest.

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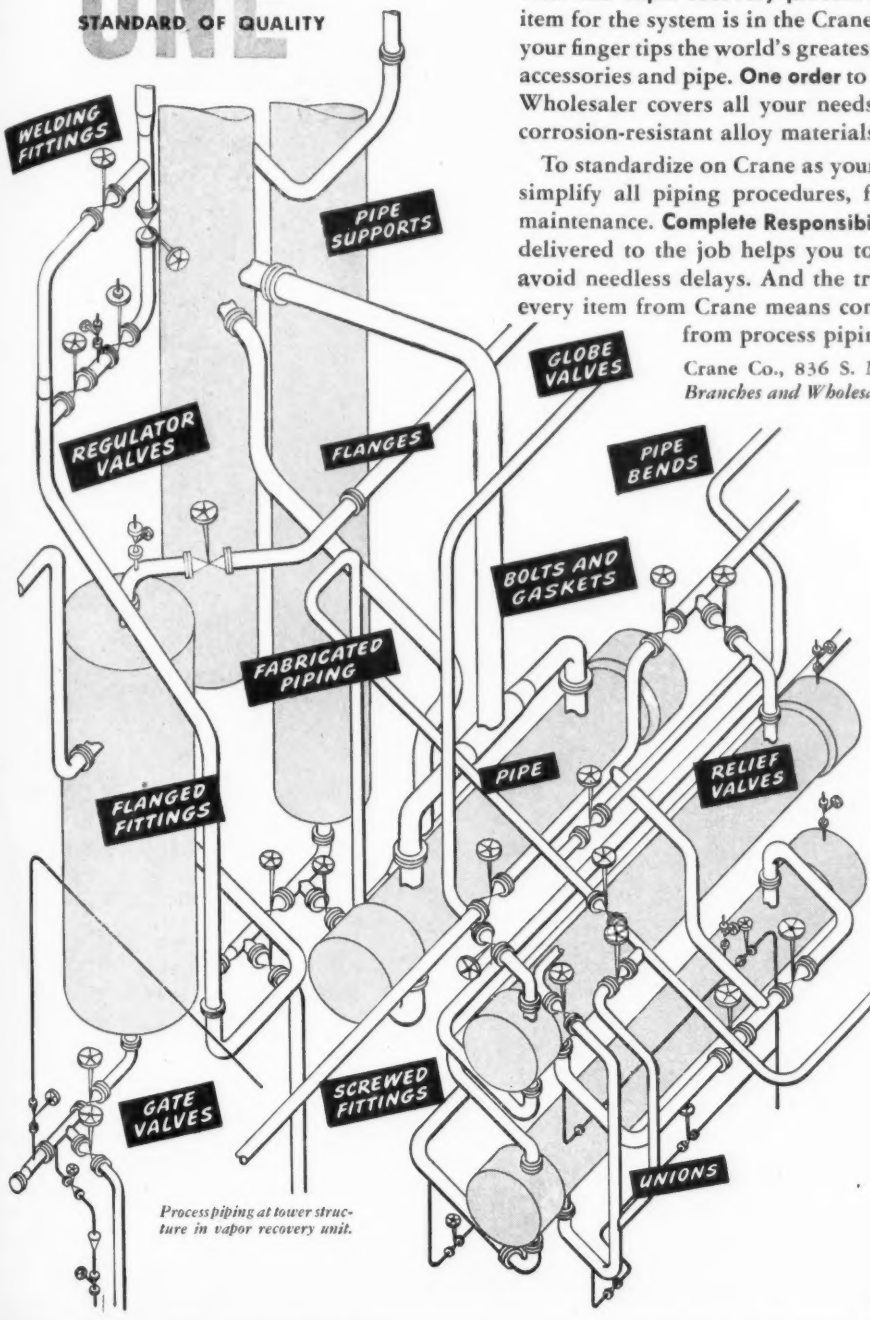

Process piping at tower structure in vapor recovery unit.

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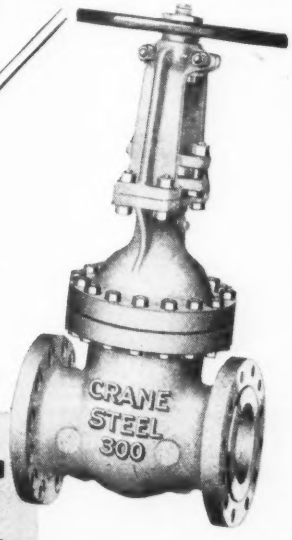

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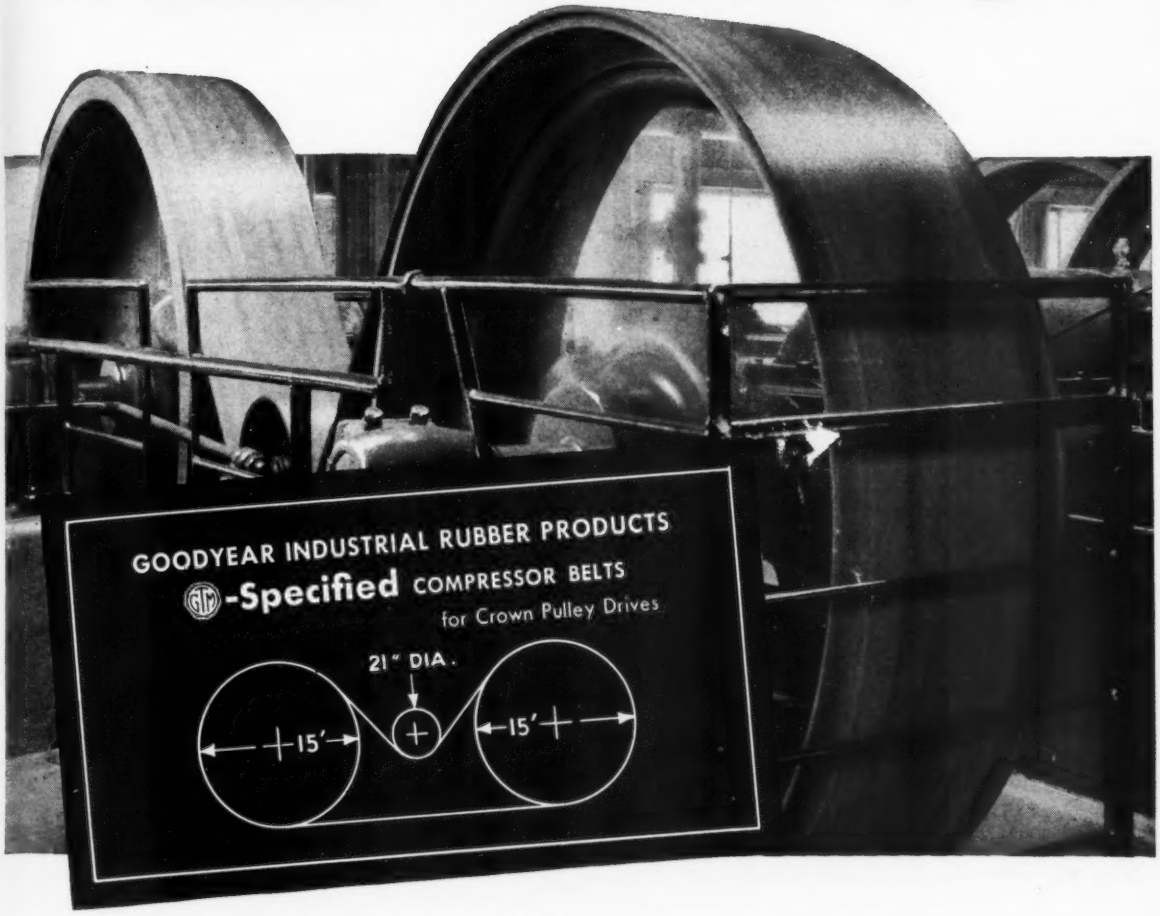

ON a compressor drive of a large Pacific Coast Oil Company, slippage, as indirect result of high crown pulleys, was once an ever-present problem. To solve it, the G.T.M.—Goodyear Technical Man—specified a special Goodyear compressor belt, made of loose-woven duck, with heavy squeegee between the plies. So successful was this belt, the Company eventually installed it on all 13 of their compressor drives. Operating 24 hours a day throughout the year, these belts have been in service from 3 to 6½ years, look good for lots more. And—slippage is no longer a problem!

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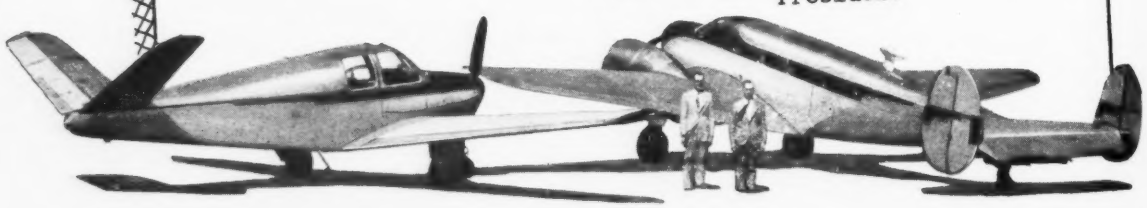
Such service has made us very aviation conscious, and we are confident that we shall continue to experience many benefits from our planes in the future.

Yours very truly,

HELMERICH & PAYNE, INC.

By W. D. Helmerich
President



THE 9-place twin-engine Beechcraft Executive Transport is a familiar sight on oil fields scattered all over the world. The Beechcraft's 200 mph speed, any-time dependability and low-cost operation make it the top-choice transportation of leading companies.

Helmerich & Payne, Inc., have recently added the Beechcraft's "smaller brother"—the revolutionary 4-place Bonanza—to the transportation setup. Its 750-mile range and 170-mph cruising speed make it well suited for shorter oil rig hops and small field operation.

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MODEL 18

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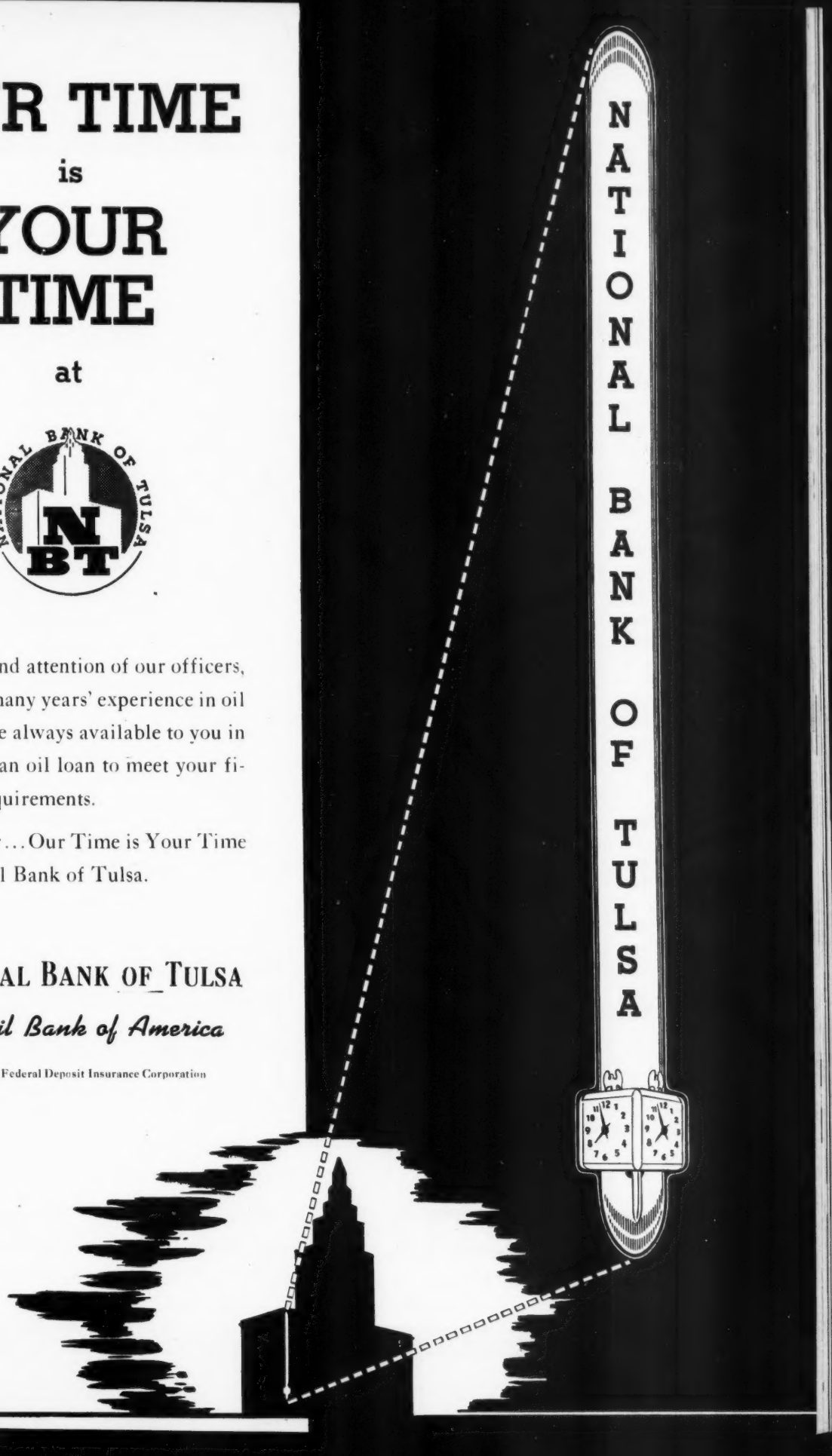

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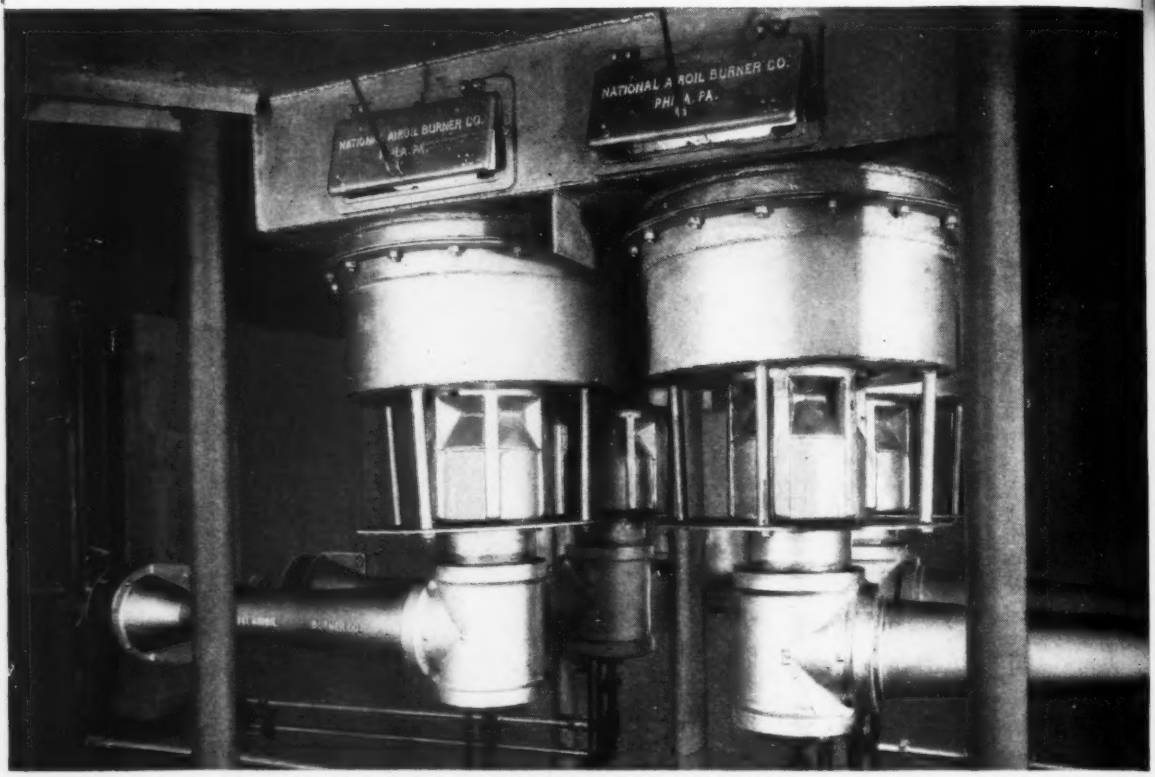

"AIROCOOL" OIL-GAS
TANDEM COMBUSTION UNITS

The above photo shows a group of four NATIONAL AIROIL TANDEM COMBUSTION UNITS, recently installed in Sun Oil Company's refinery at Marcus Hook, Penna. The burners are located at the Petro-Chem Furnace of the Vacuum Distillation Unit in this refinery. Although the installation was one of *special* application, "National Airoil" TANDEM UNITS very readily "fitted into the picture" with no trouble and a minimum of cost. This is because "AIROCOOL" TANDEM COMBUSTION UNITS are also designed for firing vertically upward, as shown, and are easily applied to all types of process furnaces.

The TANDEM UNIT maintains a high flame temperature with either fuel oil or gas; can be brought quickly to full capacity with a clean flame; and flame can be regulated and directed to uniformly radiate heat to the absorbing surfaces without flame impingement.

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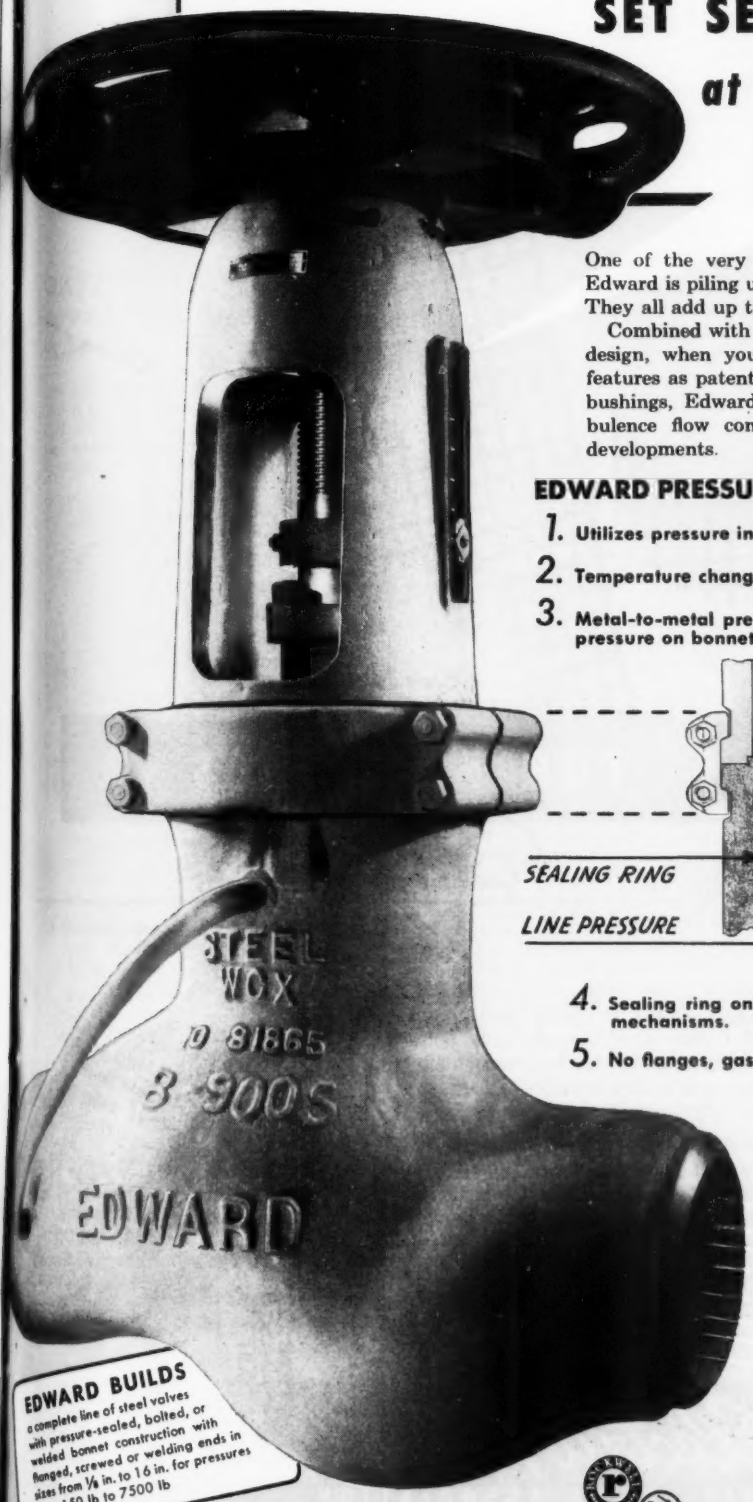
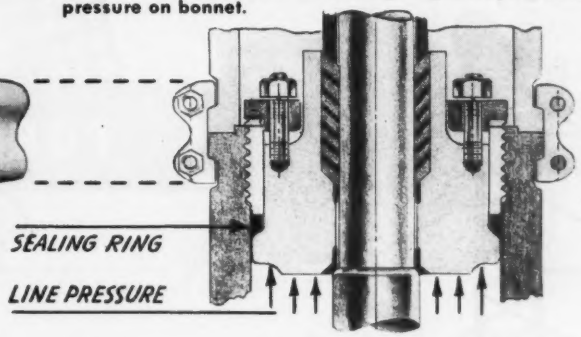


One of the very first builders of pressure seal bonnet valves, Edward is piling up experience reports from stations everywhere. They all add up the same—satisfaction.

Combined with the Edward experience on pressure seal bonnet design, when you specify Edward valves you get such extra features as patented Impactor handwheels and EValthrust yoke bushings, Edward Equalizer, closure indicators, controlled turbulence flow contouring, and many other exclusive Edward developments.

EDWARD PRESSURE SEAL BONNET JOINT FEATURES

1. **Utilizes pressure in valve to seal bonnet joint.**
2. **Temperature changes have no effect on bonnet joint tightness.**
3. **Metal-to-metal pressure on sealing ring always greater than line pressure on bonnet.**



4. **Sealing ring only seals—does not support yoke or closing mechanisms.**
5. **No flanges, gaskets or bolting to periodically re-stress.**
6. **Saves space—reduces weight.**
7. **Disassembly and reassembly, if ever required, greatly simplified and speeded up.**

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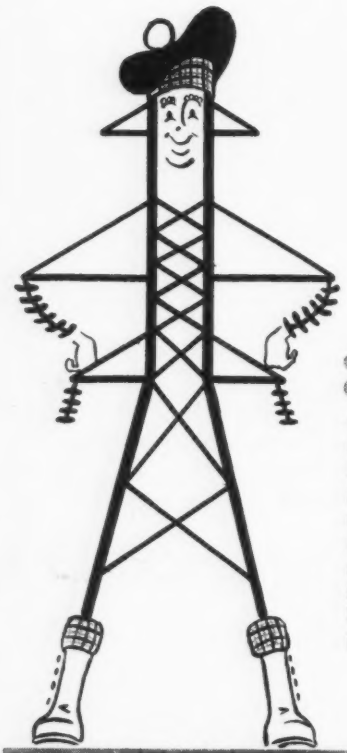
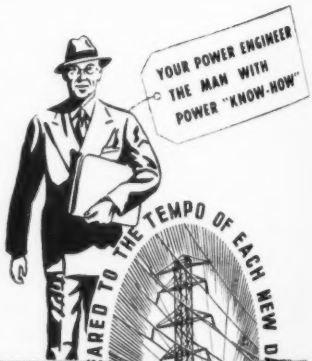
FOR PIPELINES



When it comes to pipe line operation, LCP —LOW COST POWER—has an impressive record. *Check costs!* Low first cost of power-driven equipment, low operating, maintenance and labor costs, s-l-o-w depreciation! *Check convenience!* fewer repairs, a snap to transport, automatic controls. *Check dependability!* Utility Electric Power provides smooth, *uninterrupted* performance—tailored for the individual job, yet flexible for unforeseen requirements. Call your nearest Utility Electric Power Company for the free services of the Power Engineer.

Yesterday's low price—today's high value



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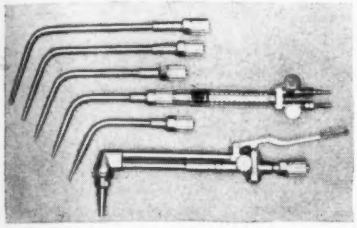
Box 1498, Oklahoma City, Oklahoma

YOUR SUPPLY DEPOT

for oxyacetylene flame and electric arc equipment and supplies

OXYACETYLENE APPARATUS AND SUPPLIES

NEW AIRCO 700 WELDING TORCH. The *new* Airco 700 is suitable for 90% of your welding and brazing work. It is available with tip assemblies ranging from Nos. 00 through 10 . . . with an individual mixer



drilled for each particular tip. This means *better flame control*—there is no sputtering, and better welds result. The *new* "700" also features:

- . . . **Wide operating range**—can weld everything from thin sheet metal up to two inch plate, and when equipped with a multi-flame tip, it's tops for silver and aluminum brazing.
- . . . **Perfect balance**—lightweight, with $\frac{3}{16}$" I.D. hose, it eliminates operator fatigue.
- . . . **Low maintenance cost**—its long-wearing monel head means fewer replacements, and reduced maintenance because rarely is reseating required.

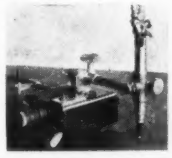
With the addition of a cutting attachment, the *new* "700" can be easily converted to handle general shop cutting work.

For heavier jobs, Airco also has available a new Series 800 Torch which is comparable to the "700" in both appearance and operating characteristics.

These outstanding *new* welding torches are but two of the many included in Airco's complete line of torches for every conceivable gas welding and cutting application.

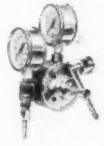
LOW-COST AIRCO NO. 10 RADIAGRAPH GAS CUTTING MACHINE. The No. 10 Radiagraph is a motor-driven, portable gas cutting machine that cuts in straight lines of any desired length, at speeds from 4" to 50" per minute. It also cuts arcs up to 42½" radius, circles from 3" to 85" in diameter, and bevels up to 40° angle. It weighs only 41 pounds net, and is easily moved from job to job.

Other types and styles of portable machines are also available, as well as a wide variety of stationary types, which operate on the pantograph principle. These machines include the popular Planograph, Oxygraph and Travograph, and are designed to cut straight lines, rectangles, circles and irregular shapes from thinnest steel sheet to thicknesses of 12" or more.



AIRCO TWO-STAGE PRESSURE REGULATORS. These popular regulators for use with oxygen, acetylene, hydrogen, or nitrogen require but one adjustment . . . the first. Once set at the correct operating pressure, they deliver a constant, non-fluctuating flow of gas from start to finish of cylinder discharge. Drops in cylinder pressure are automatically compensated for, thus enabling the operator to devote his full attention and skill to the job at all times.

Airco single-stage regulations are also available for all gas pressure uses.



AIRCO GAS WELDING AND CUTTING SUPPLIES. Airco also produces a complete line of supplies for every phase and stage of gas cutting and welding. Included in the line are: hard-facing alloys, welding rods, fluxes, cylinder trucks, tip cleaning drills, spark-lighters, gloves and goggles.

TECHNICAL SALES SERVICE
—Another Airco Plus-Value for Customers

Airco Technical Sales Service—though not a packaged commodity—is as readily available to all industry as any Airco process or product. If you have a metal working problem, ask to have a Technical Sales Division man call. Write your nearby Airco Office.

ARC WELDING MACHINES, ELECTRODES AND ACCESSORIES

NEW WILSON "HORNET 36A" DC WELDER. The Wilson "Hornet 36A" Arc Welder is the newest member of a famous arc welding machine family. It is a heavy-duty, light-weight machine designed to furnish smooth, steady current for every DC arc welding job — even under severe operating conditions.

The "36A" features simplified control of current output by means of a sturdy hand-wheel mounted on the control cabinet. Close calibration of the current dial eliminates the need for meters. Easy reversal of the polarity of the welding terminals is provided by a sturdy polarity switch. 200, 300 and 400 ampere sizes are available.

Other arc welding machines in the Airco line include the production-proved Wilson "Bumblebee" AC welders, known for their ease of operation and wide work range. These machines feature improved electrical efficiency at rated loads, wide current range, low open circuit voltage (75 volts), vastly improved power factor, quiet operation and minimum maintenance. In fact, there is a Wilson machine for every AC or DC welding purpose.

AIRCO AC/DC ELECTRODES (Including Stainless Steel and Hardfacing Alloys). Time-tried and production-tested, Airco's vast line of electrodes is engineered to supply the right answer for every welding problem. They range from general-purpose, mild-steel electrodes through the new special electrodes for welding "difficult" metals and alloys, and generally are available in both AC and DC types.

AIRCO ARC WELDING ACCESSORIES include helmets, electrode holders, cable, clamps, gloves, brushes, and other items.

GASES

AIRCO OXYGEN, ACETYLENE AND RARE GASES are known throughout industry for their purity, economy and operating characteristics.

CARBIDE

NATIONAL CARBIDE (in the red drum) is made from the finest available coke and limestone. It is evenly sized and dust-free, and gives a high, uniform yield of acetylene gas.

For more information on the products on this page, as well as those making up Airco's complete line, write for a copy of Catalog ADC-640A. Address, Dept. OG-8866, Air Reduction, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas. On West Coast: Air Reduction Pacific Company, San Francisco 4, Calif. Represented internationally by Airco Export Corp.

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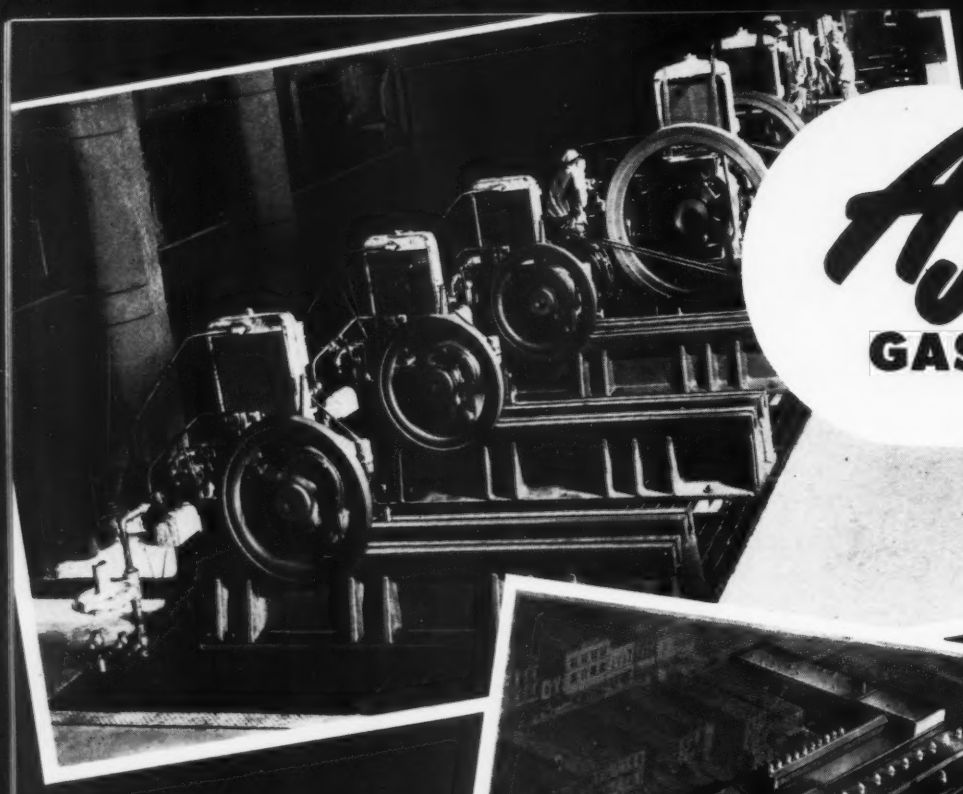
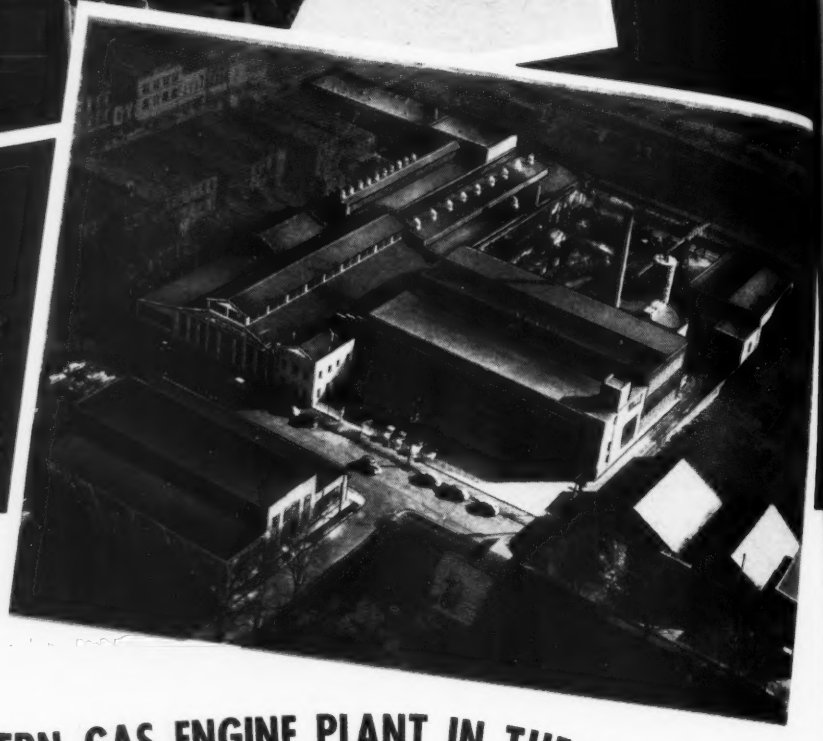
Offices in all principal cities



Ajax GAS ENGINES



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. . . in the MOST MODERN GAS ENGINE PLANT IN THE WORLD!

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A vital part of the Ajax Gas Engine manufacturing program is the greatly-expanded and modernized Ajax plant itself. Always one of the most highly-tooled engine builders, Ajax now takes a place second to none in complete facilities for Gas Engine production.

Ajax craftsmen, employing the finest equipment, translate advanced Ajax engineering into Gas Engines serving the oil industry with greater efficiency—better economy—and constant reliability, year after year. *Yes, in the Gas Engine field, things are happening at Ajax!*

AJAX IRON WORKS

Manufacturers of Gas Engines · Steam Drilling Engines · Industrial Steam Engines

CORRY, PENNSYLVANIA

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Large Houston stocks of the following nationally-recognized products:

- **STAINLESS STEEL** Stud Bolts, Nuts, Cap Screws, Ells, Tees, Unions, Couplings, as well as forged Steel, 3000- and 6000-lb. working pressure.
- **MASON-NEILAN** Reducing and Back Pressure Regulators—Liquid Level Controllers—all types for Oil, Gas, Steam or Water service.
- **CAST STEEL** Flanged End Gate Valves, Forged Steel Globe Valves, Gate and Check Valves.
- **SEAMLESS STEEL** Tube-Turn Welding Fittings, Ells, Tees, Caps and Reducers; Forged Steel Flanges—threaded, slip-on, welding neck, and blind—in sizes from ½" to 24" O.D.
- **HAGAN** Control Equipment, Hall Laboratories Water Conditioning.
- **NATIONAL** Seamless Steel Pressure Tubing, Seamless Steel Heat Exchanger and Condenser Tubes.
- **SMITH** Meters and SPARLING Meters, for your measuring problems in oil, gas, water, and other liquids.

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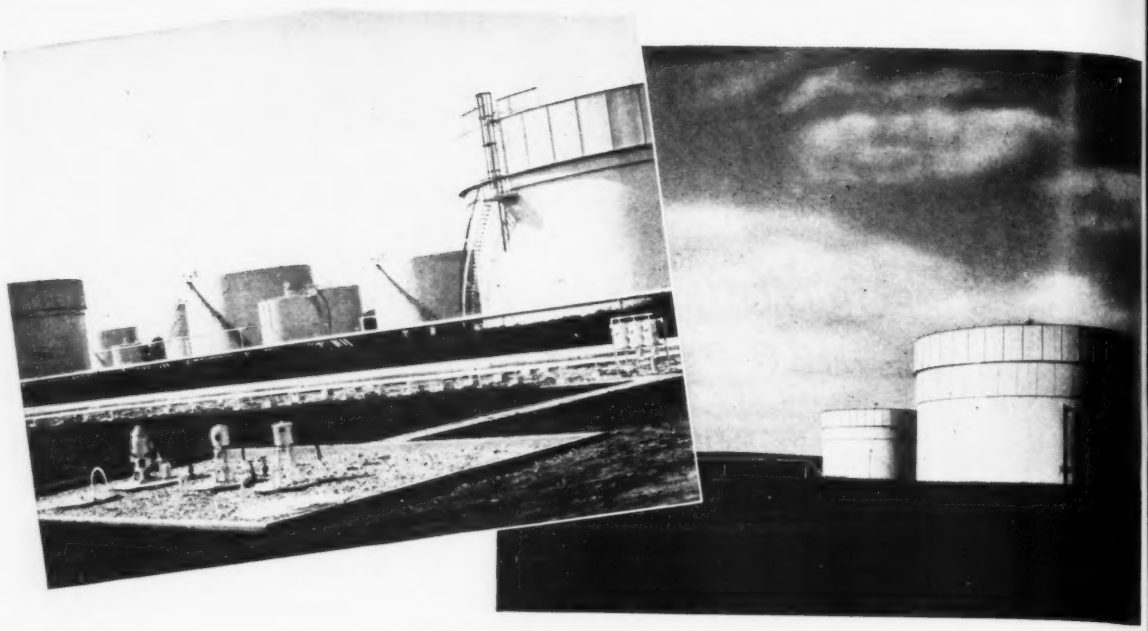
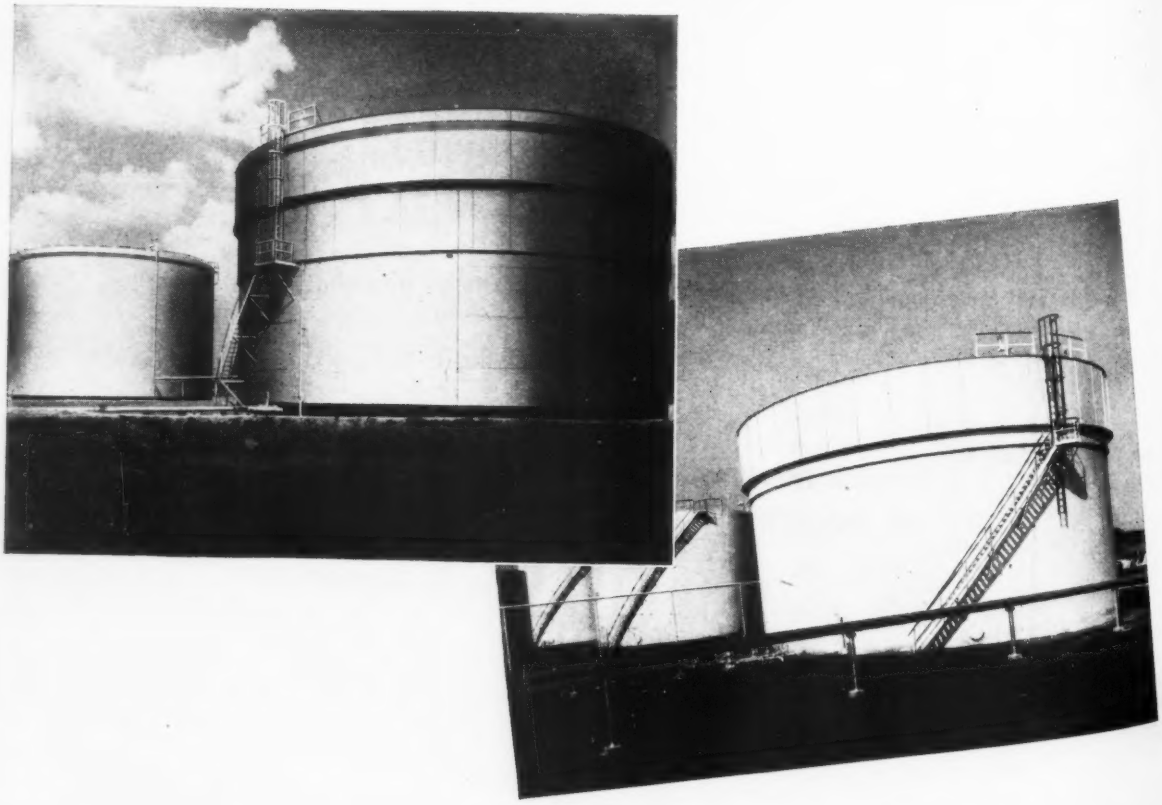
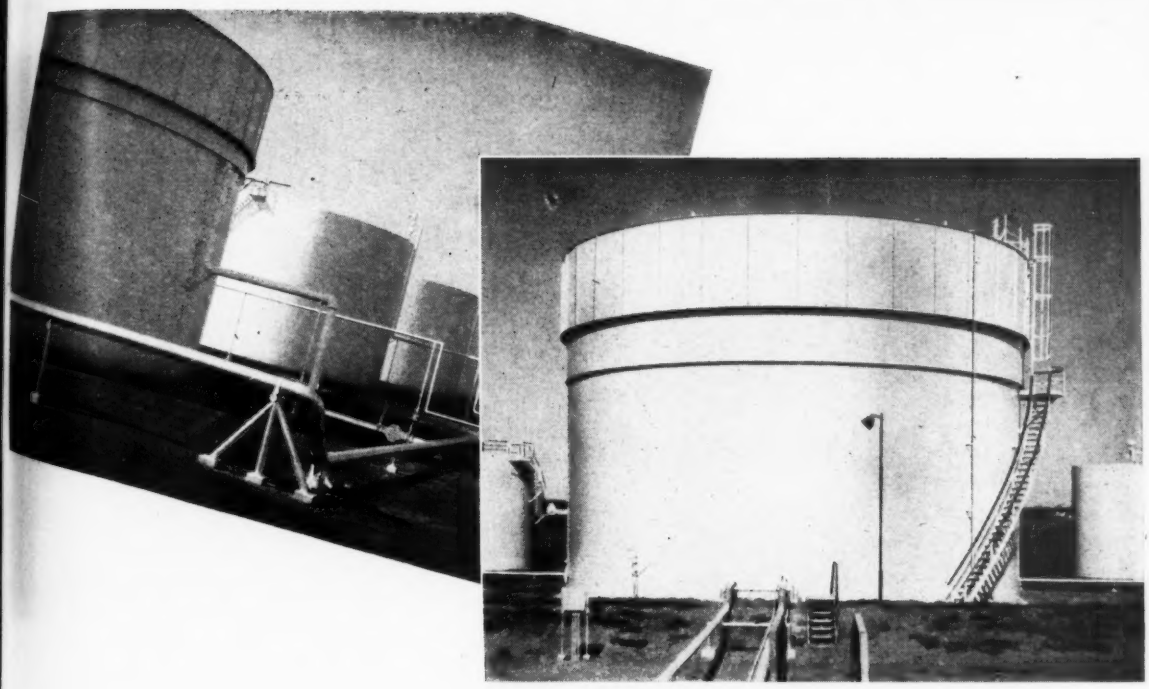
MECO



More EXPANSION





ROOFS ARE USED BY PRODUCTS PIPE LINES

It's a fact that products pipe lines have in service, under erection or planned, *at least ten times as many Expansion Roof tanks as all other types of gasometer roof tanks combined.* It's a ten-to-one ratio . . . the result of nine years dependable service . . . of nine years effectively conserving petroleum products in storage. It's proof of the many advantages the Expansion Roof alone offers to terminal operators who know the importance of eliminating vapor losses.

What's behind this universal acceptance of the Expansion Roof? Virtually complete conservation for one thing . . . together with simplicity of design, very low maintenance, dependability, accuracy of gauging and efficient operation in any climate.

Take conservation. The products pipe line terminal offers an outstanding example of the Expansion Roof at work.

In normal operation, the filling process is continuous with pumping in proceeding at a constant rate during both day and night. During the working day, filling and the expansion of vapors due to higher daytime temperatures is offset by normal withdrawals. During the night, filling is offset by a "shrinking" of the vapor space due to lower temperatures. The expansion Roof or Roofs take care of any difference in volume under normal conditions. It is a balanced system which eliminates most vapor losses . . . both filling and standing.

Expansion roof tanks are available in a complete range of capacities with roof lifts from five to ten feet depending upon the installation which they are to serve. Equally efficient in single or multiple tank installations (connected through a manifold system), Expansion Roof tanks give *complete* protection.

Write today for details or quotations on the accepted conservation equipment for products pipe lines.

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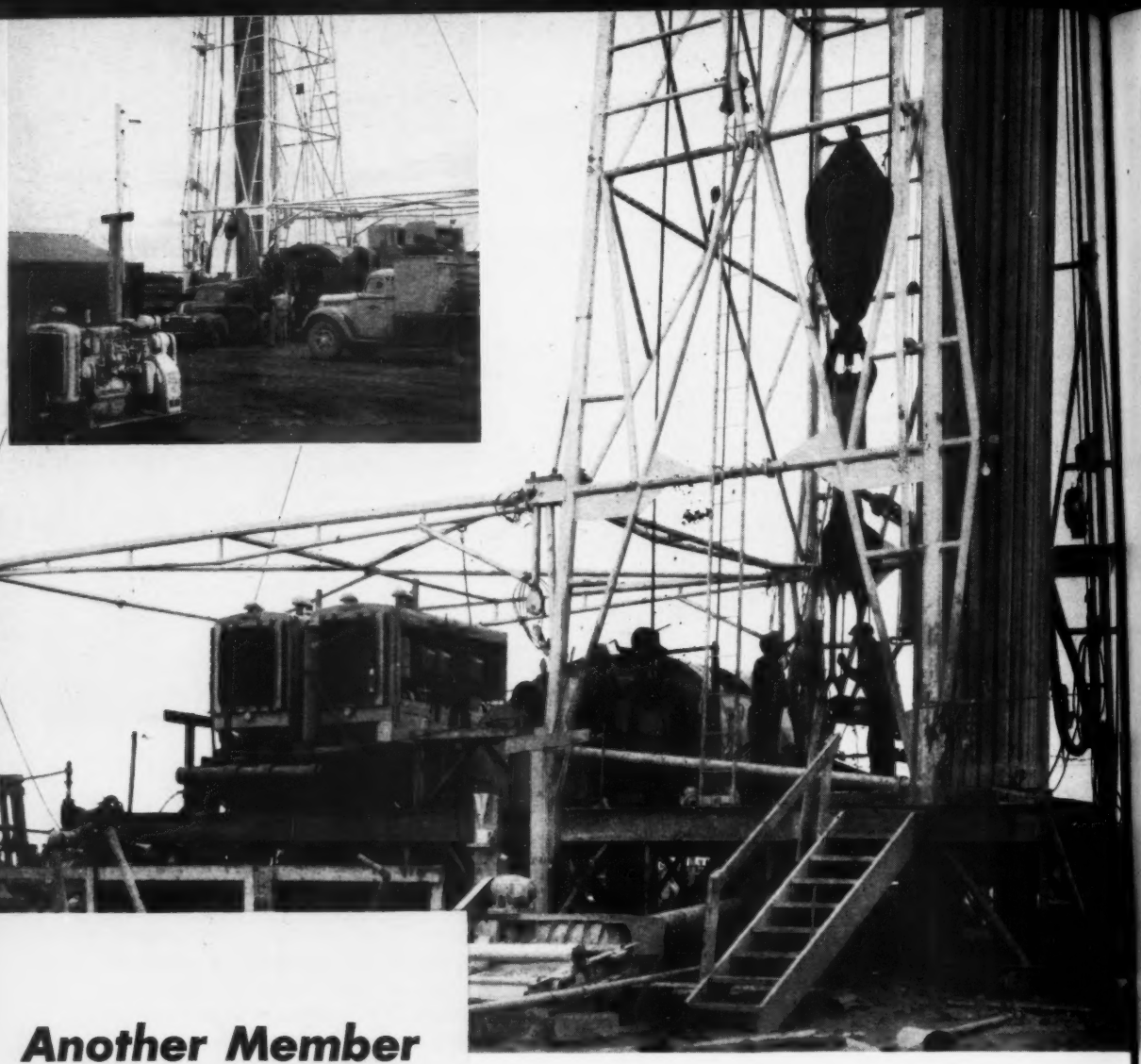

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EARTHMOVING EQUIPMENT

AT ITS Homestead Yaremko No. 1 well, near West Nisku, Alberta, General Petroleum Ltd. has a power set-up that works just right—and it's all "Caterpillar."

Two "Caterpillar" Diesel D17000 Engines power the pump and rotary draw works, and a "Caterpillar" Diesel D3400 Electric Set furnishes current for lights, shop and small motors.

Such use of "Caterpillar" power is typical of oil-field drilling operations from Alberta to Arabia—and points up the value of standardizing on "Caterpillar" Diesel Engines, Tractors, Motor Graders and Earthmoving Equipment. Long life, proved dependability and low operating cost—plus the economy of getting parts and mechanical service from one nearby dealer—make "membership" in the "100% 'Caterpillar' Club" a mighty sound and profitable step.

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McGOWAN DUPLEX SIDE POT POWER PUMPS

IMMEDIATE DELIVERY on 6" stroke power pumps

The McGowan Pump Division of the Leyman Manufacturing Corporation guarantees accurate workmanship and durable service. An experienced Engineering Department is available for information on installations and requirements. Highly efficient and ruggedly constructed — McGowan Pumps have the ability to stand up year in and year out under severe service conditions.

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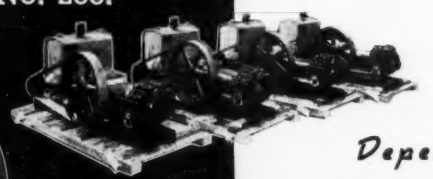

Dependable since 1852

McGOWAN PUMPS

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The JOHN H. McGOWAN Co. DIVISION
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In 1925 Halliburton operations were confined to parts of Texas, Oklahoma, Arkansas and Louisiana.

Today Halliburton equipment, strategically located throughout the United States, is available at all times to old and new customers, wherever they be operating.

Additionally, Halliburton equipment serves in the sand-baked deserts of Asia, the tropical jungles of Sumatra, the barren wastes of the North, and in the countries of South America.

Basic in all of Halliburton's operations and plans is the policy of justifying the confidence of the industry by living up to the obligations that such confidence implies. High among those obligations is that of keeping pace with the industry's progress and a step ahead of its needs.

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HALLIBURTON OIL WELL CEMENTING CO.
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THE ANTIMONIAL ADMIRALTY THAT'S TESTED BY TIME IS PATENTED BY CHASE

SINCE 1935 the resistance of Chase Antimonial Admiralty Heat Exchanger Tubes to dezincification has been remarkable. Why? Because Chase-patented admiralty has always contained more than the minimum amount of antimony to give protection against the escape of zinc.

Experience has shown that once the antimonial content goes below .007% (the minimum set forth in Chase Patent No. 2,061,921) there is relatively little protection. Chase's admiralty contains a nominal amount of 0.035% antimony to allow for commercial variation sometimes encountered. This assures you of an antimonial content of about .015% —the minimum necessary for reasonably complete protection. *That's why it pays to insist on Chase Antimonial Admiralty. Write today.*

Special stocks of ANTIMONIAL ADMIRALTY Condenser Tubes in Chase Warehouses: BALTIMORE, NEW ORLEANS LOS ANGELES, SAN FRANCISCO *also carried by—* Vinson Supply Co., Tulsa Standard Brass & Mfg. Co., Houston

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It's the *SIDES* of a V-BELT That Really Get the WEAR!

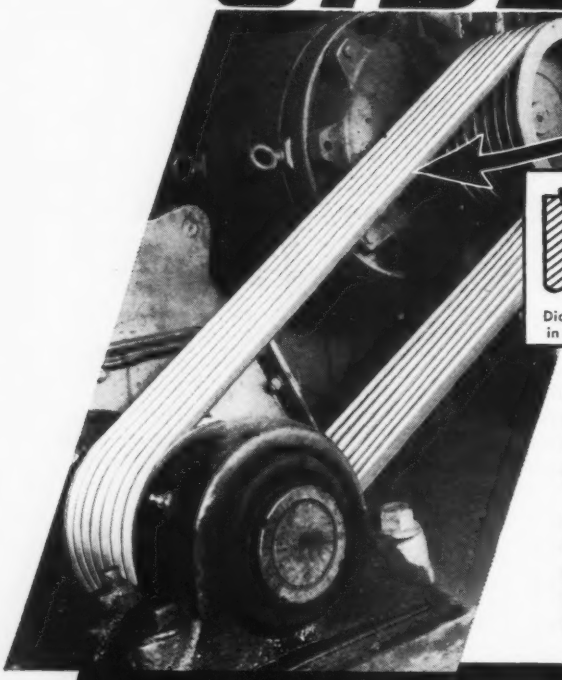


Diagram of V-Belt in Sheave Groove

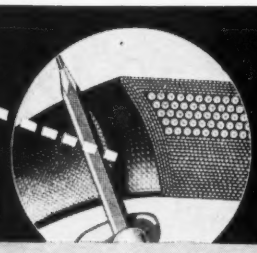
Look at this diagram of a V-Belt in its sheave. You see at once that the *sides* of the belt do all the gripping on the pulley and get all the wear against the sheave-groove wall.

It's the *sides*, moreover, that pick up all the power delivered by the driver pulley. The sides *transmit* that power to the *belt as a whole*. And then, once more, its the sides—and the sides *alone*—that grip the driven pulley and *deliver* the power to it.

The fact that the *side* is the part that does the work and gets the wear explains why you have always noticed that the sidewall of the *ordinary* V-Belt is the part that wears out *first*. Naturally, then, when you lengthen the life of the sidewall you lengthen the life of the belt.

Now See How the CONCAVE SIDE... SAVES Sidewall Wear and Lengthens Belt Life!

U. S. PATENT NO. 1813698



The simple diagrams on the right show exactly why the ordinary, *straight-sided* V-Belt gets excessive wear along the *middle of the sides*. They show also why the Concave Side *greatly reduces* sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

Saving Sidewall Wear is MORE IMPORTANT NOW Than Ever Before!

Now that Gates SPECIALIZED Research has resulted in Super Vulco Ropes capable of carrying much heavier loads—fully 40% higher horsepower ratings—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important now than ever before!

Fig. 1

Straight Sided V-Belt

Fig. 1-A

How Straight Sided V-Belt Bulges When Bending Around Its Pulley

You can actually feel the bulging of a Straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.

Fig. 2

Gates V-Belt with Concave Sidewall

Fig. 2-A

Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt is Bending Over Pulley.

No bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

THE GATES RUBBER COMPANY, DENVER, U.S.A.

"The World's Largest Makers of V-Belts"

489

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

Gates

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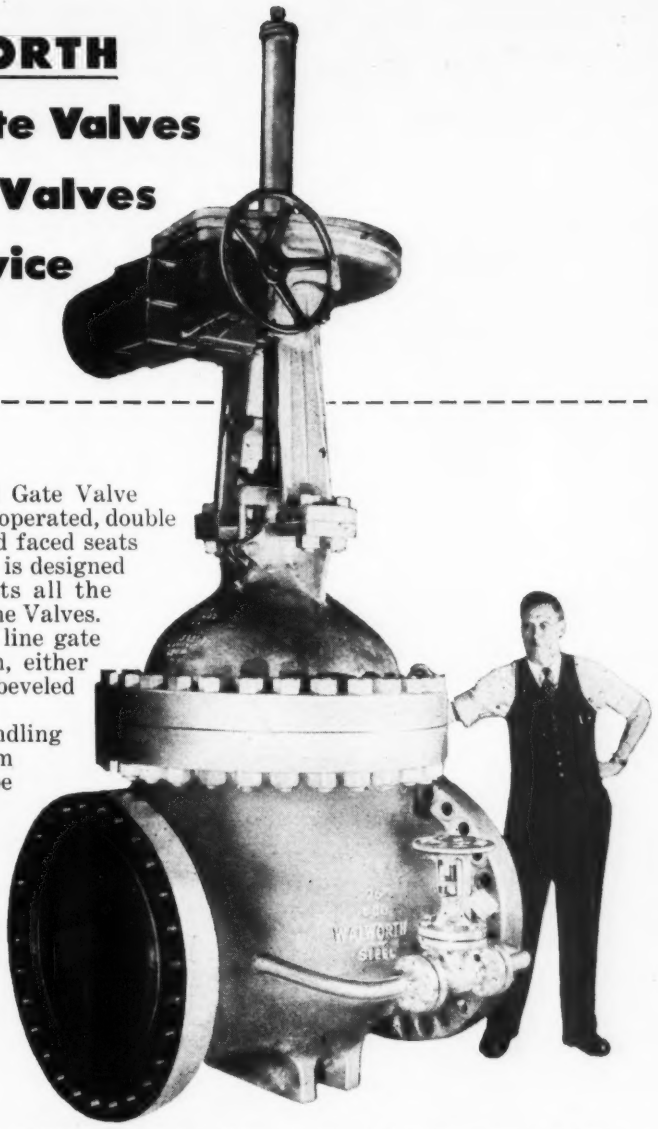
WALWORTH

manufactures both Gate Valves and Lubricated Plug Valves for pipe line service



The Walworth 26-inch Series 600 Cast Steel Gate Valve shown here is for pipe line service. It is a motor operated, double disc, parallel seat type of gate valve with hard faced seats and discs; flanges faced and drilled. The valve is designed for 1200 psi working pressure — and meets all the requirements of API Standard 6-D for Pipe Line Valves.

In addition to motor operated valves, pipe line gate valves are available for handwheel operation, either direct or through single or double enclosed beveled gears.

Walworth Pipe Line Gate Valves are handling crude oil, fuel oil, gasoline, and other petroleum products in many of the most important pipe lines of the world.

In addition to double disc cast steel pipe line gate valves, another popular valve for pipe line service is the Walworth Lubricated Plug Valve.

Illustrated is a Walworth 26 by 24-inch Lubricated Plug Valve for 960 pounds working pressure, with a high pressure cylinder for use in conjunction with automatic valve control. Manufactured for service on a natural gas pipe line.

- Made of cast steel and conforms to API Standard 6-D for Pipe Line Valves.
- Roller bearings permit easier opening under pressure.
- Tight sealing — resistant to wear and corrosion — dead tight shut-off — pressure sealed.

For further information regarding either Gate Valves or Lubricated Plug Valves for Pipe Line service, see your nearby Walworth distributor, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N.Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

ISOLATE ANY SECTION OF A TRANSMISSION LINE

WITH MUELLER LINE STOPPERS AND EQUIPMENT

H-17255 Welding Fitting as Furnished with Cast Iron Plug and Completion Cap.

C-1 Power Operated Drilling Machine Attached to Gate Valve on the Welding Fitting.

H-17335 Stopping Machine with By-Pass Rubber Stopper Expanded in the Welding Fitting.

H-17255 Welding Fitting with Completion Cap as it Remains on the Line.

Proven in Use by America's Major Oil Companies!

The use of Mueller Line Stoppers and Equipment enables you to insert Mueller Rubber Line Stoppers at any desired point in the line and isolate any section regardless of the location of the gate valves. The section of pipe to be repaired or replaced can be shut off completely or by-passed without draining the line.

There are many other uses for this equipment on feeder lines and around refineries and storage plants as the Line Stoppers and Equipment range in size from 1¼ to 8 inches.

GAS AND OIL COMPANIES

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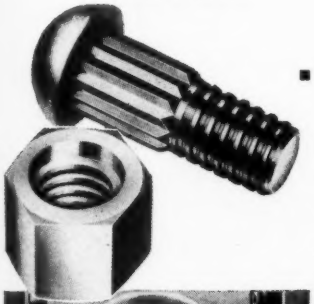
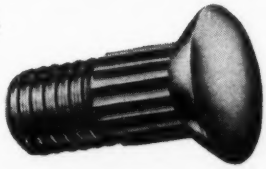




Erect your structural steel with just a man, a maul and a wrench—and Dardelet "Rivet Bolts." You'll save time and money.

IN all kinds of construction—from the smallest job to the largest structure—the wide use of DARDELET Self-Locking "RIVET BOLTS" has proved their superiority. They are unsurpassed for holding steel members and parts together, no matter how severe the service. They are stronger, faster to handle than rivets—in construction as well as in the repair of all kinds of machinery. Can also be furnished in hot dip galvanized or electro plated. And they're approved by Federal, State and Municipal codes.

Here are some advantages of DARDELET "RIVET BOLT" construction:

LOWER COSTS. No expensive heating or driving equipment is needed.

NOISE REDUCTION . . . so often an important consideration in repair or remodeling jobs in occupied buildings.

SPEED. Fewer men can drive more Rivet Bolts per day. Bolts drive in . . . nuts spin on freely until they contact the work.

MATERIAL SAVING. Rivet Bolts may be removed and structural members used again. Disassembly is easy . . . fast.

SHEAR AND BEARING VALUES . . . equal to power-driven rivets or turned bolts in reamed holes.

Fill in and mail the coupon—now—and a sample Dardelet "Rivet Bolt" will be sent you absolutely free—along with complete information about this superior method of joining steel parts.

United States Steel Supply Company,
Dept. C9, P. O. Box MM, Chicago 90, Illinois
Please send me without obligation, sample Dardelet "Rivet Bolt," and literature describing use.

Name..... Title.....

Firm Name.....

Street.....

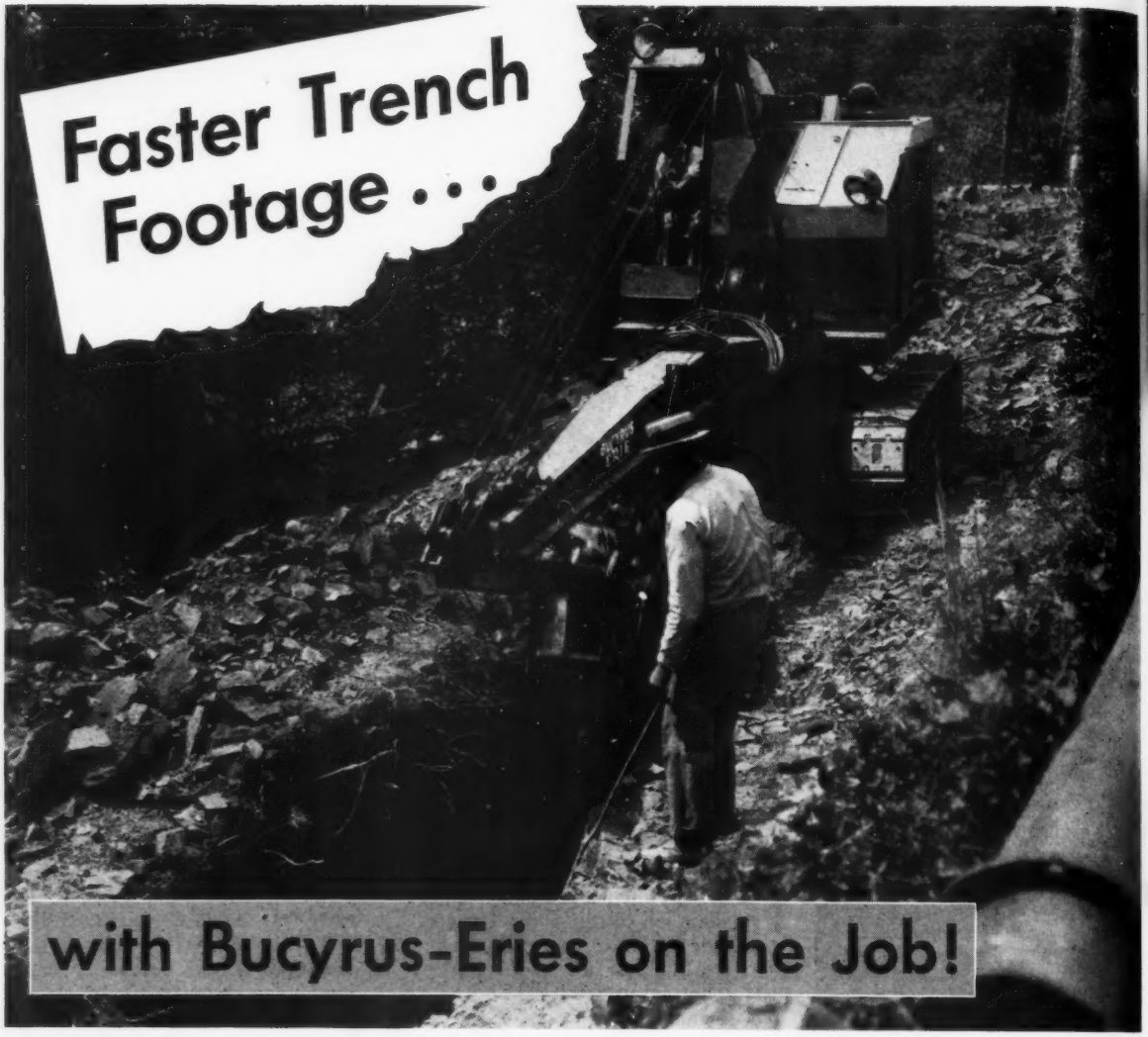
City..... Zone.... State.....

UNITED STATES STEEL SUPPLY COMPANY
USS STEELS SERVICE

UNITED STATES STEEL SUPPLY COMPANY

CHICAGO (90) CLEVELAND (14) NEWARK (1), N. J. SAN FRANCISCO (1)
BALTIMORE (3) LOS ANGELES (54) PITTSBURGH (12) TWIN CITY
BOSTON (Allston 34) MILWAUKEE (1) ST. LOUIS (3)

UNITED STATES STEEL



THAT'S one thing you can be sure of when you put a Bucyrus-Erie dragshovel on your pipeline jobs . . . trenches grow fast, cut clean and true. Owners know that Bucyrus-Erie design means the balance of speed and power that steps up output . . . the quick hoist and swing that combines with a powerful digging stroke to produce big yardages in a hurry.

All-welded dragshovel dippers add to efficiency with an extended dipper lip that penetrates easily and helps the long sidecutters in holding extra material. They're built with a high arch for easy filling without voids, tapered front to rear for fast, clean dumping.

See your Bucyrus-Erie distributor for more about these hard-working, dependable machines. He'll be glad to give you complete information.

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

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Hinged!

FOR EASY OPERATION

Improved

UNIBOLT SCRAPER TRAP

FOR 8" TO 28" PIPE

18" UNIBOLT Closures replacing blind flanges on Moorlane Strainers.

EXTRA HINGES AVAILABLE FOR INSTALLATION ON UNIBOLT SCRAPER TRAPS ALREADY IN SERVICE

Pipeliners, who for years have struggled with heavy, multi-bolt blind flange closures on scraper traps, will welcome this easy-opening, sure-sealing UNIBOLT Scraper Trap. You just release two bolts and s-w-i-n-g the trap cover, or blanking plug, out of the way. A simple hinge carries the load. It's absolutely safe, eliminating heavy lifting, and there's nothing to fall on the workmen. Swing it shut, tighten two bolts, and the line is ready for business again!

Many operators who installed UNIBOLT Scraper Traps before the hinge design was available are now converting to the new design by installing the hinges on the job.

Any line or unit that requires a closure, such as Strainers, Separators, Scrubbers, Mist Removers and similar pressure vessels, may be UNIBOLT-equipped to real advantage. Wherever a blind flange is applicable, a UNIBOLT Coupling with Blanking Plug will seal tighter, reduce weight, and save time.

THORNHILL-CRAVER CO.
Houston, Texas

Monel* Fastenings Resist Corrosion, Rust, Heat, Cold, Shock, Vibration, Overstressing!

EMBLEM OF SERVICE

INCO

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DO YOU NEED extra safety and longer life in fastenings? Then switch to *Monel** fastenings. *Test their performance for yourself!* Just let us know the type and size you need. We'll send you a sample and refer your inquiry to your nearest distributor. All types are readily available from stock. For a sample of the Anchorfast nail and list of distributors, write to Mr. Bob Johnson of Inco.

*Reg. U. S. Pat. Off.

THE INTERNATIONAL NICKEL COMPANY, INC. *67 Wall Street, New York 5, N. Y.*

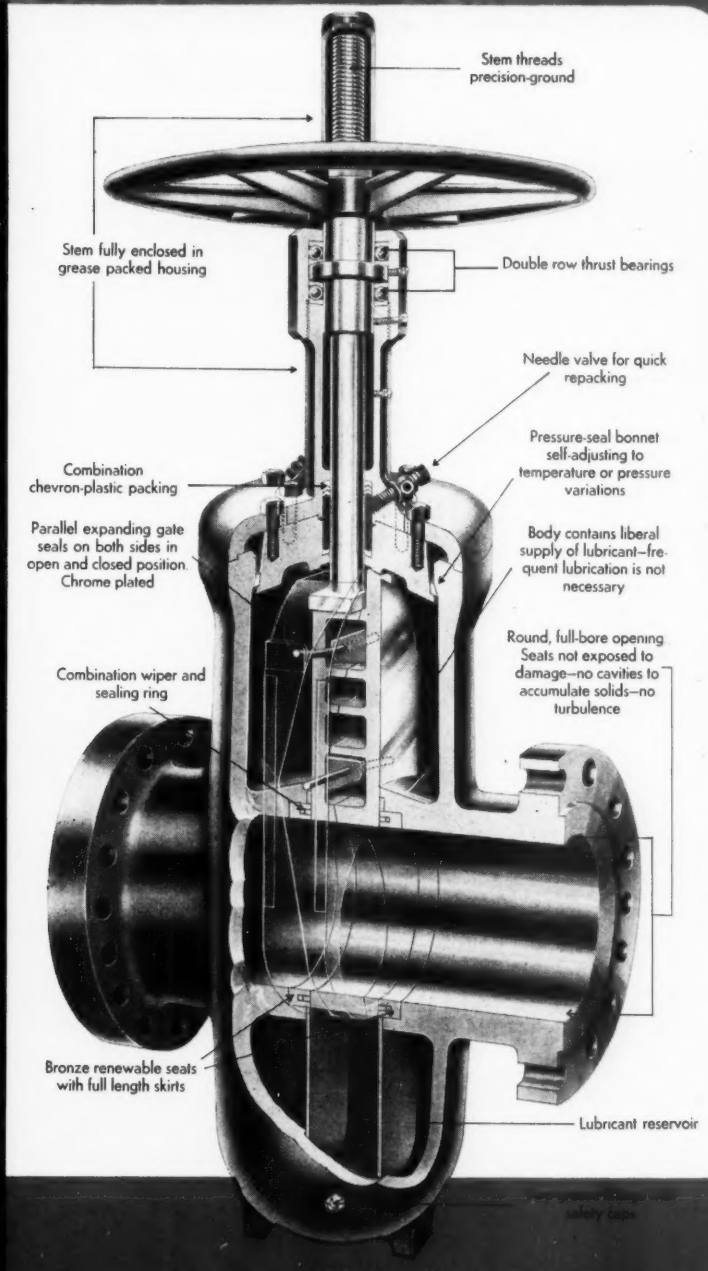
Why

YOU WILL FIND W•K•M PIPE LINE VALVES

on most recently completed pipe lines . . . domestic and foreign

Pipe line service has welcomed the round full bore (or round venture) opening of W-K-M Pipe Line Valves. There is no turbulence, no gate cavities to collect solids and no seats exposed to flow. W-K-M Pipe Line Valves are made for all services, gas, oil or finished Products. W-K-M Pipe Line Valves, for one thing, are the only pipe line valves that provide positive shut-off every time on both sides.

Check the other features of this new standard for the pipe line industry, and do not accept less pipe line value than the exclusive W-K-M features offer. Made in Series 300 - 400 - 600 - 900 - 1500.


Stem threads precision-ground
Stem fully enclosed in grease packed housing
Double row thrust bearings
Needle valve for quick repacking
Pressure-seal bonnet self-adjusting to temperature or pressure variations
Combination chevron-plastic packing
Parallel expanding gate seals on both sides in open and closed position. Chrome plated
Body contains liberal supply of lubricant—frequent lubrication is not necessary
Round, full-bore opening. Seats not exposed to damage—no cavities to accumulate solids—no turbulence
Combination wiper and sealing ring
Bronze renewable seals with full length skirts
Lubricant reservoir

W-K-M Company, Inc.

OIL FIELD, PIPE LINE & INDUSTRIAL EQUIPMENT

HOUSTON, TEXAS, U. S. A.

Cable Address "WILKOMAC"

Export Office 30 Rockefeller Plaza, New York, N. Y.

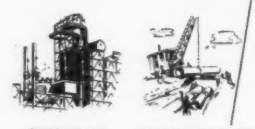
Can You Use Bank Credit and Oil Know-How To *Step Up* Your Profits?

N. B. C. Invites You To Talk Shop!

More and more oil men are discovering that it pays them to consult N.B.C. when they need additional capital for exploration, production, refining or shipping.

They know that N.B.C. is an experienced hand at bank credit for oil loans . . . that their oil department, headed by a seasoned oil man, can "talk shop" in the oil man's language.

We're right on the spot, cut all red tape, and give you the kind of service that steps up profits in oil operation. The address is 712 Main . . . the atmosphere friendly and informal.



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Capital and Surplus . . . $8,000,000.00

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"THE BANK OF COURTESY"

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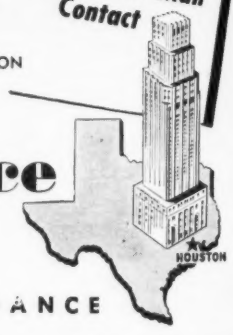
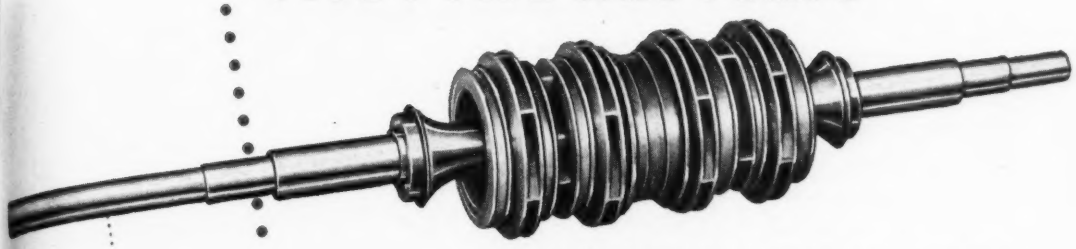


FOR A BALANCED OPERATING AND MAINTENANCE BUDGET SPECIFY PACIFIC *Precision Built* TYPE F PIPE LINE PUMPS

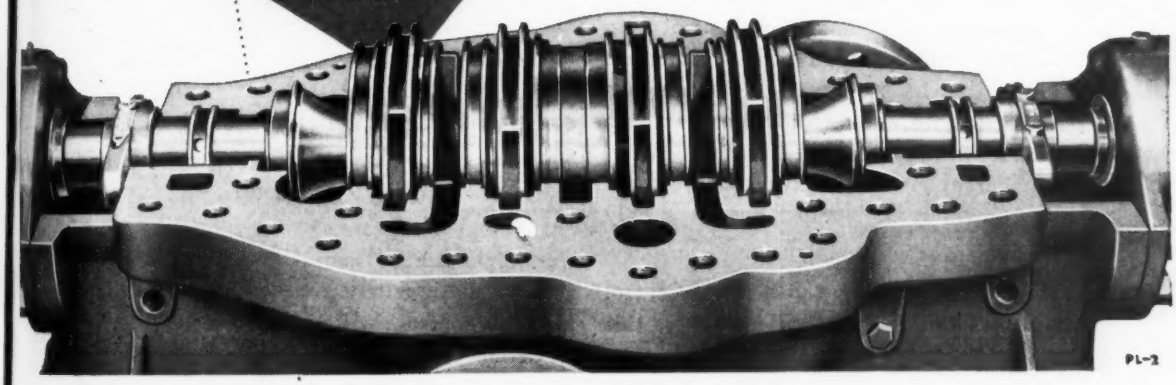


Mechanical equipment requires a certain amount of inspection and maintenance to prevent major troubles. When inspection is simple, it is most likely to be made.

PACIFIC TYPE F PIPE LINE PUMPS ARE EASY TO INSPECT AND MAINTAIN IN THEIR MOST EFFICIENT OPERATING CONDITION because they may be dismantled and reassembled quickly with the minimum of labor.

The removal of the upper-half casing permits the shaft, with all rotating and non-rotating interior parts, to be removed from—and installed in—the lower-half casing as a complete assembly. This assembly may be taken to the most convenient point for inspection and any worn parts replaced. ***Worn parts are quickly installed because Pacific Precision means each part is FINISHED TO SIZE.***

BALANCED MECHANICAL DESIGN for strength, simplicity, accessibility, and easy maintenance.
BALANCED HYDRAULIC DESIGN for sustained efficiency.
BALANCED DYNAMICALLY AND HYDRAULICALLY to eliminate costly effects of vibration, shaft deflection, and excessive bearing loads.



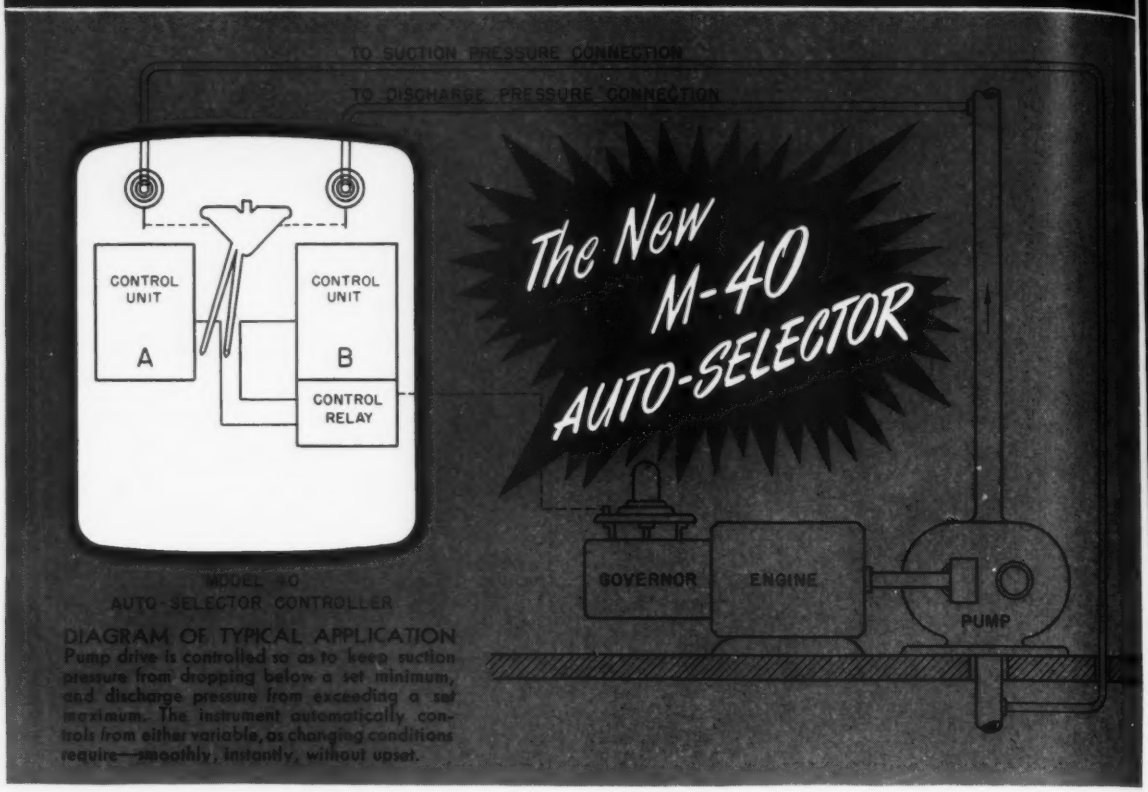
PL-2

WRITE FOR BULLETIN 103

PACIFIC PUMPS INC.
HUNTINGTON PARK, CALIF.

One of the Dresser Industries
Offices in all Principal Cities
Export Offices: Channin Bldg., 122 E. 42nd St., New York

HERE'S 1 CONTROLLER THAT HOLDS 2 RELATED VARIABLES WITHIN SET LIMITS



MODEL 40
AUTO-SELECTOR CONTROLLER

DIAGRAM OF TYPICAL APPLICATION
Pump drive is controlled so as to keep suction pressure from dropping below a set minimum, and discharge pressure from exceeding a set maximum. The instrument automatically controls from either variable, as changing conditions require—smoothly, instantly, without upset.

THE NEW FOXBORO AUTO-SELECTOR CONTROLLER operates from two related measurements, automatically transferring control from one to another as required, to prevent either one from exceeding its set limit. As in the case diagrammed above, when supply is greater than demand, control is maintained on the demand side (discharge) . . . but when demand exceeds supply, control is maintained on the supply side (suction).

Having two measuring elements and control mechanisms, and a combined air relay, this instrument actually does the work of two . . . and provides records of both measurements on one chart. It will be seen that either one or the other variable is under control at all times. Due to the unique design and inter-relationship of controller elements, the transfer of control from one variable to the other is smooth, instant, and with no upset.

Any type of control action may be used. Any combination of related variables may be controlled—pressure and flow, temperature and level—or two flows, two pressures, etc.

If you have a process that might benefit from this automatic selection type of control, write for details. **The Foxboro Company, 60 Neponset Ave., Foxboro, Massachusetts, U. S. A.**

FOXBORO
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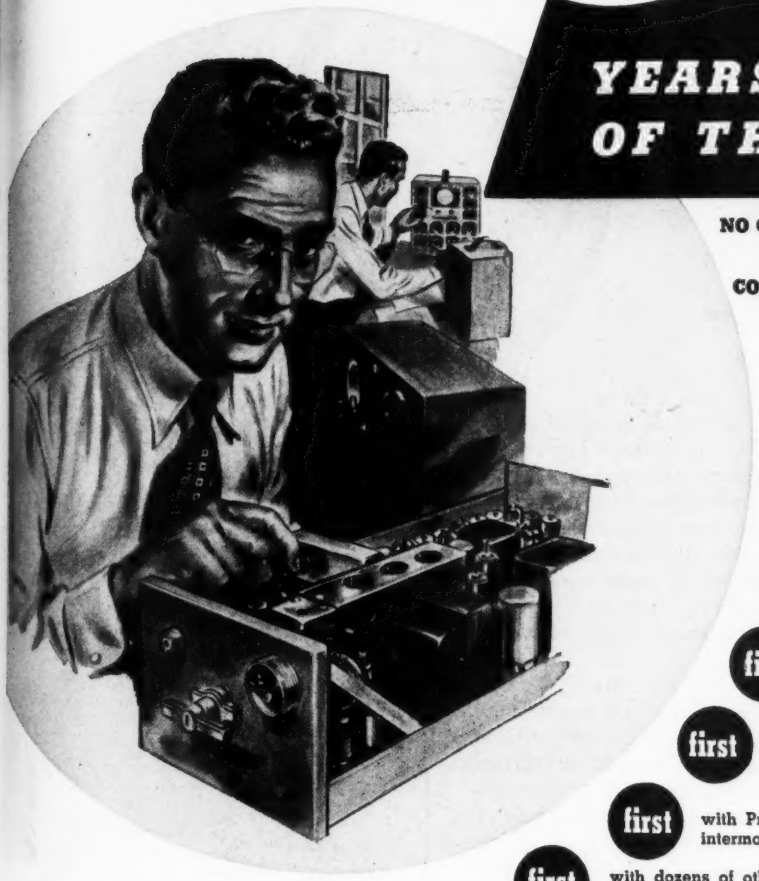
RECORDING · CONTROLLING · INDICATING
INSTRUMENTS

Motorola FM 2-way radio

YEARS AHEAD OF THE FIELD!



NO OTHER MANUFACTURER CAN MATCH THIS LIST OF *Motorola* RADIO COMMUNICATION "FIRSTS"

- **first** with noise-compensated squelch that makes present day 2-way radio communications practicable. (U.S. Patent 2343115)
- **first** to develop the vibrator power supply in receivers—now accepted as the best power supply system.
- **first** with 20 D.B. quieting at 0.4 microvolt input.
- **first** to build successfully equipment for the 152-162 mc. band.
- **first** with "Precision Selectivity" for channel conservation.
- **first** with Precision Cavity for intermodulation control.
- **first** with dozens of other major developments in radio communications.

Inspired engineering and careful craftsmanship are your guarantee that the *Motorola* equipment you buy today will be *years ahead for years to come!*

Of course the Motorola equipment you buy today will last longer — that has been proved by hundreds of official records. But just as important to you is the fact that the Motorola equipment you buy today is guaranteed against early obsolescence by the many advanced developments it incorporates — developments that will not be duplicated in other equipment for months — or years. Motorola is able to stay ahead of the field because it has the largest FM 2-way radio communications laboratory and more qualified radio communications developmental engineers than any other manufacturer in the industry — BAR NONE.

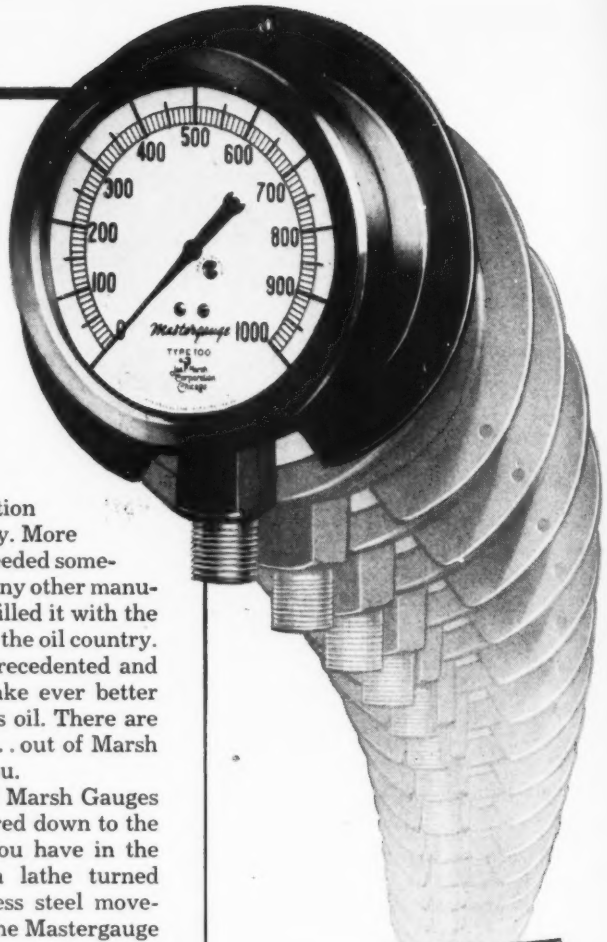
See for yourself how much MORE Motorola gives you. A Motorola Communications Engineer will be glad to call and discuss radio communications as it concerns your specific problems. He'll put you in touch with people in your business who are using Motorola equipment. He'll give you FACTS, not fiction — FIGURES, not fables — WRITE TODAY.

Motorola
FM 2-WAY RADIO

Motorola Inc.

Communications Division: 4545 Augusta Blvd., Chicago 51, Ill.
Canadian Distributor: Rogers Majestic Ltd., Toronto - Montreal

No Restrictions in this flow—



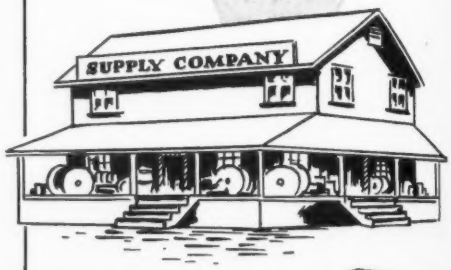
• There is no "happenstance" about the position Marsh Gauges occupy today in the oil industry. More than any other industry, the petroleum field needed something better in pressure gauges . . . more than any other manufacturer, Marsh interpreted this need and fulfilled it with the Mastergauge and other Marsh instruments for the oil country.

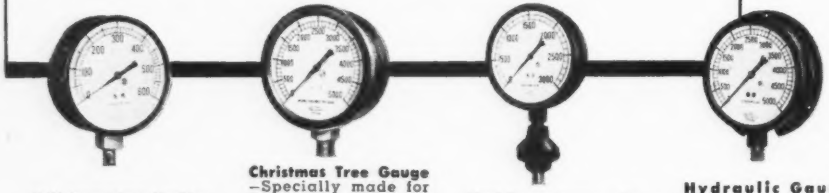
The recognition of this, expressed in unprecedented and ever growing demand, has enabled us to make ever better gauges and distribute them wherever there is oil. There are no restrictions in the flow of Marsh Gauges . . . out of Marsh plants . . . through your supply store . . . to you.

Your local supply house has a full line of Marsh Gauges for the oil industry—gauges that are engineered down to the last detail for every service encountered. You have in the Marsh Mastergauge an instrument with a lathe turned bourdon tube, a precision monel and stainless steel movement, a moistureproof and vaporproof case. The Mastergauge is guaranteed accurate within ½ of 1% of reading and is available in types for every application—as a Christmas tree gauge, an oil country boiler gauge, and, with protecting diaphragm, as a mud pump gauge. Also included in the Marsh line are the finest of hydraulic and Reid Vapor Test gauges.

Ask your supply store for the new Marsh bulletin, "Gauges for the Oil Industry" or write us for your copy.

JAS. P. MARSH CORP., Dept. L, Skokie, Illinois
Export Dept., 155 E. 44th St., New York 17, N. Y.





Oil Country Boiler Gauge—The Mastergauge specially made for oil country boilers.

Christmas Tree Gauge—Specially made for Christmas trees. These gauges incorporate ruggedness and accuracy beyond all others.

Mud Pump Gauge—The Mastergauge with protecting diaphragm of advanced design.

Hydraulic Gauge—Finest of hydraulic gauges in pressure ranges up to 30,000 lbs. per square inch.

FOR YOU
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FOR PREMIUMS

Handsome New Marsh Duo-Temp Thermometer shows outdoor and indoor temperatures *inside* your home or office. Reads like a clock. Highly accurate. Write for details.

She has to take chances

. . . YOU CAN PLAY SAFE

And Reduce Repair Costs On High-Speed Diesels!

Install Porous Chrome* Piston Rings! That's the way to *play safe*. You guard against the cost of disrupted schedules and frequent piston ring replacements. Many sizes of these rings are now made of F-88 Metal, a new centrifugally-cast iron with 2½ times greater strength and a 50% higher modulus of elasticity, making them *unbreakable in service*. Porous Chrome rings seat immediately—eliminate the costly wear of the break-in period. They reduce cylinder wear by half . . . give you *extra* savings by eliminating the need for chrome-plated cylinder liners.

Don't take chances! Take a tip from leading Diesel engine builders who play safe with Koppers American Hammered Porous Chrome Rings. There is a piston ring combination, including Porous Chrome compression rings, for any high speed engine—for new equipment or replacement jobs.

Koppers Company, Inc., Piston Ring Division
Box 626, Baltimore 3, Maryland

*VAN DER HORST PROCESS

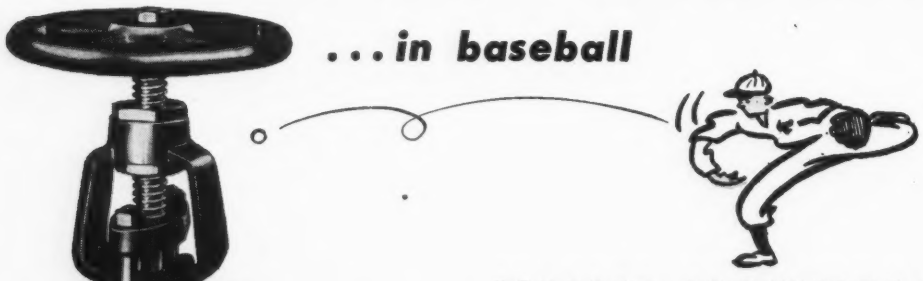
KOPPERS

Making piston rings is just one way in which Koppers serves Industry. Koppers also produces chemicals from coal. It manufactures flexible couplings, roofing, paving materials, airplane propellers. It is a leader in the wood preserving industry. It designs and builds most of America's coke ovens. There are many Koppers products or services that can help your business. Koppers Company, Inc., General Offices, Pittsburgh 19, Pa.

IN EVERY SIZE • OF EVERY TYPE • FOR EVERY PURPOSE

American Hammered Piston Rings

SPECIALISTS GET BETTER RESULTS



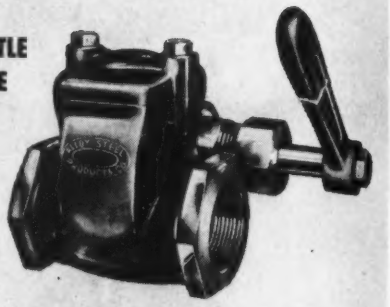
...in baseball

...and in VALVE MANUFACTURE

ALOYCO
ANGLE VALVE
No. 331

ALOYCO
GLOBE CHECK VALVE
No. 45A

ALOYCO
LEVER THROTTLE
GATE VALVE
No. 120



● The best pitcher in the big leagues would probably be only a second-rate catcher. This specialization in professional baseball is equally sound in the manufacture of corrosion-resistant valves. In order to make the very highest quality valves of stainless steels and related alloys, we have found it necessary to focus the entire facilities of our organization on this one product. We make nothing but valves—and we make them of nothing but corrosion-resistant alloys. The peculiarities of these metals make it necessary for the valve manufacturer to have long experience in their handling, to obtain maximum results.

It is this experience and skill that Aloyco offers to concerns in the process industries who require the very best in corrosion-resistant valves —from the standpoint of the best alloy for the purpose and correct mechanical design. Write us regarding your requirements.

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VALVES AND FITTINGS

GATE, GLOBE, Y, CHECK, TANK, SAMPLING AND 3-PORT VALVES
SCREWED AND FLANGED FITTINGS

ALLOY STEEL PRODUCTS COMPANY, INC.

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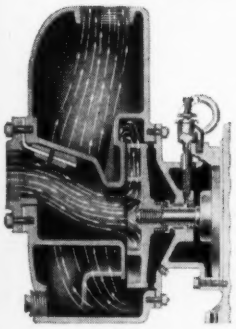
Nothing Doing—

BARNES PUMPS give me 33,000 for 1 odds . . .

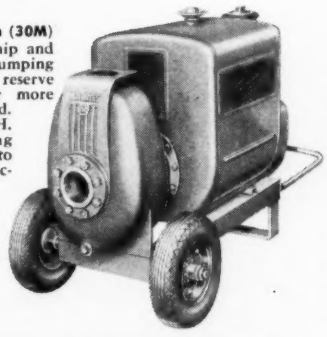


Here's What "Makes 'Em Tick"

See how the suction is direct-in-line with the impeller? This means less friction loss (easier to handle the suction hose, too). Barnes Automatics are streamlined inside, as well as outside. This and other design features make for the striking economy and performance of Barnes Pumps.

That's right! There's no gamble with odds like this. Barnes Automatics deliver not 1000! Not 10,000! But 33,000 gallons of water for 1 gallon of gas used. That's equal to filling 4⅛ tank cars. That's what you call economy — genuine and unmatched! And this economy is yours when you buy Barnes Automatic Centrifugals — the 33,000 for 1 Pumps.

4-in., The Sensation (30M)
Built like a battleship and will take as much pumping punishment. Has reserve capacity to deliver more volume when needed. Rating 30,000 G.P.H. Other self-priming pumps from 3,000 to 90,000 G.P.H. capacities.



STREAMLUXE Barnes LINE

MAIL THIS COUPON TODAY!

Barnes Manufacturing Co.
611 North Main Street
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Please send me descriptive literature on pumps marked below:

____Gasoline-engine driven automatic centrifugals
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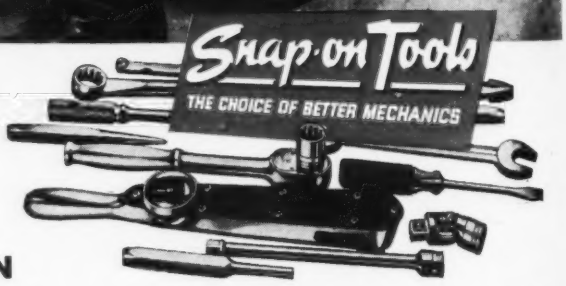
BARNES MANUFACTURING CO.
MANSFIELD, OHIO

Tough Nuts in tight spots are easily serviced with Snap-on Tools

For service and maintenance work on your big drilling engines — for dozens of odd jobs in the "cracking" plant — right down to tightening the smallest flange nuts, Snap-on gives you the "right" wrench for every operation. Your crews gain greater speed and accuracy *with more safety* . . . you cut "down time" to a minimum. Snap-on wrenches are available in standard sizes from 45/8" down to the tiny 3/16" sockets, and are adaptable to a large variety of oil field jobs by simply interchanging handles and sockets.

Machinist pictured is using an Extra Heavy Duty Snap-on Ratchet in dismantling one of the huge slide valves of a catalytic cracking plant.

Snap-on Tools are available through a nationwide, direct-to-user tool service, operating from 40 strategically located factory branches. Write for Snap-on's 104-page 1948 catalog.



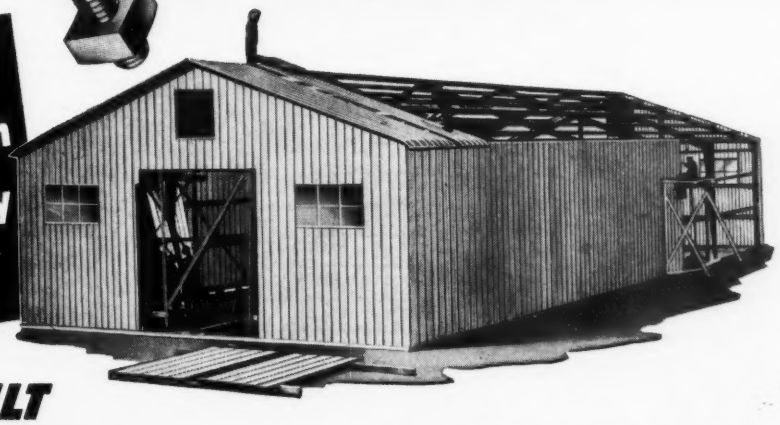
SNAP-ON TOOLS CORPORATION

8098-H 28TH AVENUE • KENOSHA, WISCONSIN

International Division: Kenosha, Wisconsin, U. S. A.

Bolted Construction

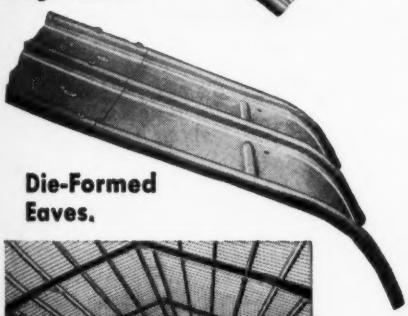
Means
Greater Strength
Greater Rigidity
Lower Cost



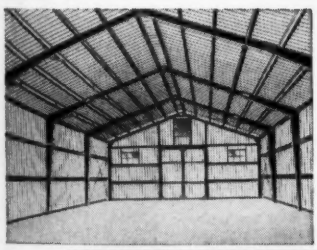
in BUTLER BUILT STEEL • ALUMINUM BUILDINGS

First Rigid Frame Truss-Clear Design To Be Mass-Produced

One-Piece Roof Ridge Sheet.



Die-Formed Eaves.



Secure, strong fastening of metal to metal is best accomplished with bolts. That's why Butler buildings rely solely on bolts (inserted, *not driven*, through precision-punched holes) to hold aluminum sheets together and to hold these sheets securely to the steel building frame. There is no rupture or tearing of sheets—there are no loose rattling sheets to leak and reduce the service life of buildings and increase costs of upkeep.

3 ADAPTABLE SIZES. 40 ft. width, length in any multiple of 20 ft. Also, 20 ft. and 32 ft. widths, lengths any multiple of 12 ft.

60 ft. width available in Bowstring Truss type.

Check These Other Butler Features

- **Full Space Use. Truss-clear, straight sidewalls.**
- **Special deeply corrugated aluminum sheets.**
- **Width, Length, Height Variable.**

CONTACT YOUR NEAREST BUTLER BUILDING DISTRIBUTOR

BUTLER MANUFACTURING COMPANY
KANSAS CITY, MO. GALESBURG, ILL. RICHMOND, CALIF. MINNEAPOLIS, MINN.

Address Inquiries to:
7464 East 13th St., Kansas City 3, Mo. or
964 Sixth Ave. S. E., Minneapolis 14, Minn.
or Dept. E, P. O. Box 1072, Richmond, Calif.

Send Complete Information on Butler Building viz:
☐ 40 ft. wide x ____ ft. long ☐ 32 ft. wide x ____ ft. long
☐ 60 ft. wide x ____ ft. long ☐ 20 ft. wide x ____ ft. long

NAME _____
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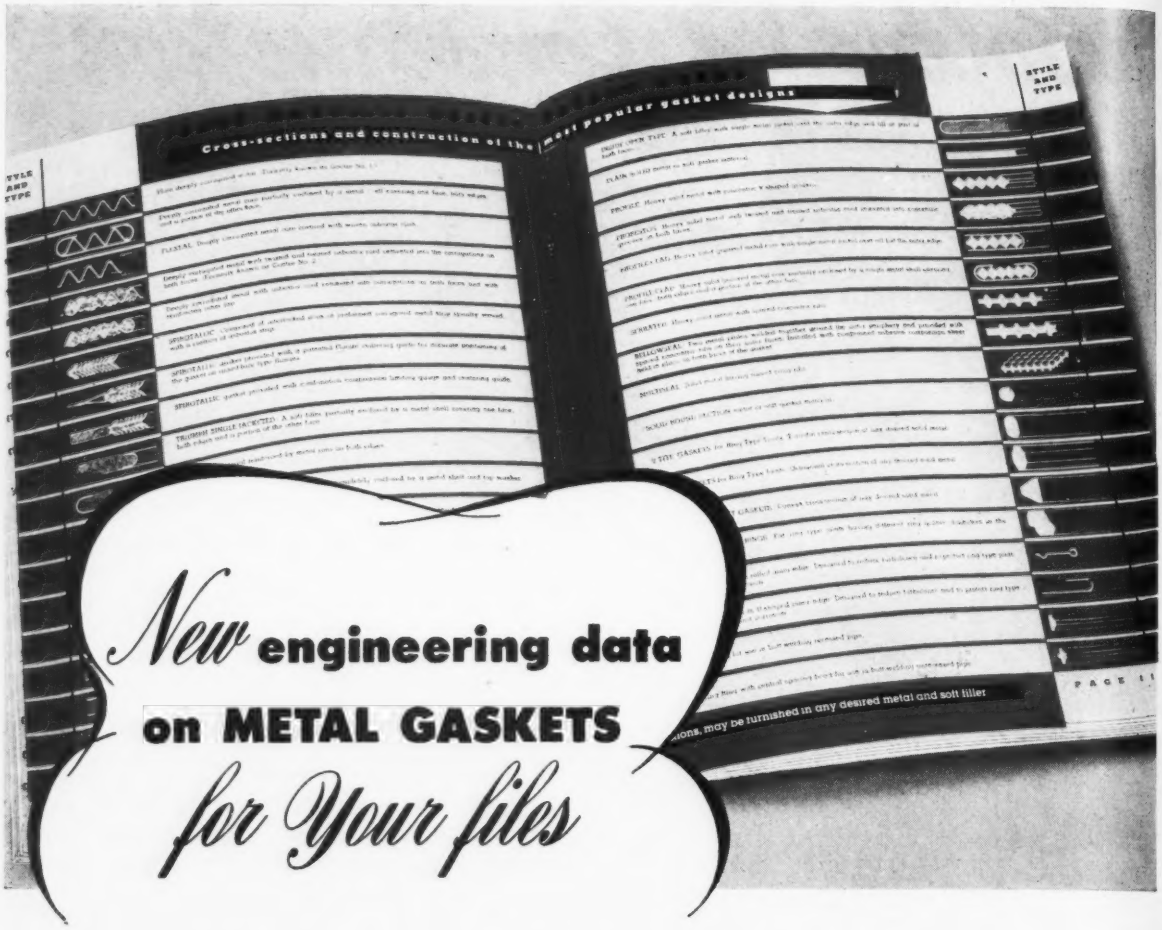
CITY _____ ZONE _____ STATE _____



New **engineering data on METAL GASKETS** *for Your files*

. . . cross-sections and construction details included in new Johns-Manville Goetze catalog

THE HANDY reference chart shown above is one of many features of the new J-M Goetze Gasket catalog which make it easier for you to select metal gaskets. It gives cross-sections and construction details of more than 30 basic Goetze Gasket designs that are available now to meet your requirements.

Here, too, you will find complete descriptions of such noteworthy developments as the Goetze Bellowseal—the gasket with the automatic self-sealing expansion joint for high temperature, high pressure service . . . the versatile Spirotallic with its combination of high mechanical strength and resilience . . . the Goetze V-Tite, a special solid metal gasket for sealing ring type joints . . . as well as the many styles of boiler, cylinder head and heat exchanger gaskets in the complete Goetze line.

In fact, there isn't an important metal gasket development which is not covered—or a single metal gasket problem to which the new J-M Goetze Gasket catalog won't help you find a practical, money-saving answer!

If you buy or use metallic gaskets, you will want to have full information about these latest Goetze developments at your finger tips. Write, on your company letterhead, for your copy of the new Goetze Gasket catalog. Address Johns-Manville, Box 290, New York 16, N.Y.

SEND FOR YOUR COPY TODAY

The new Goetze Gasket Catalog containing the handy gasket reference chart shown above has 48 pages of up-to the-minute gasket information. Write for your copy today.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville *Goetze* Gaskets

Continuous PIPELINE Service

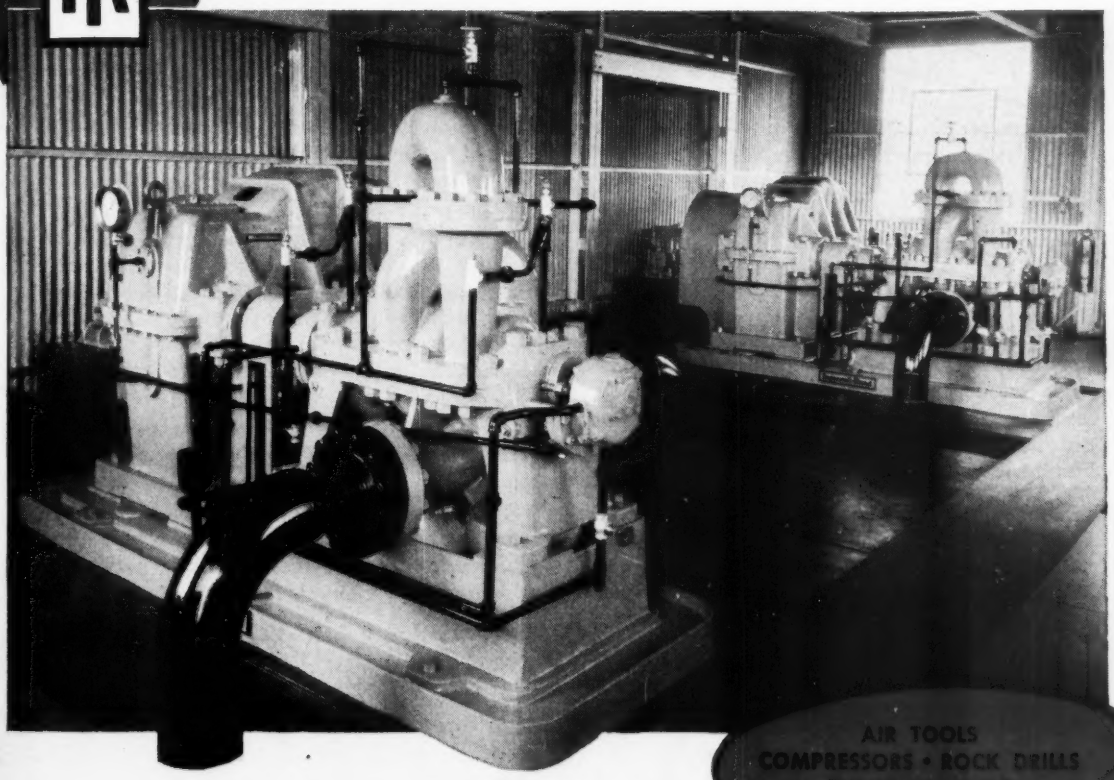
The movement of petroleum through the nation's pipelines is a 24 hour-a-day job—day after day, week after week—thousands of barrels per hour, millions of barrels per week.

Ingersoll-Rand has specialized in pumps for this exacting service for many years. Class RT multi-stage units and class BHV single-stage units are installed on pipelines not only in this country but also in many foreign oil fields.

Class RT and BHV pipeline pumps include all mechanical and hydraulic features that make for reliable operation—heavy duty bearings, balanced impellers, heat treated steel shafts protected throughout by intermediate sleeves and impellers—and other important features too numerous to mention.

All Ingersoll-Rand pipeline pumps can be equipped with the famous I-R Cameron Shaft-Seal, which replaces the packing in the stuffing box and practically eliminates any stuffing-box maintenance.

Contact an I-R engineer. He will be glad to give you the full details on our pipeline pumps and the Cameron Shaft-Seal.



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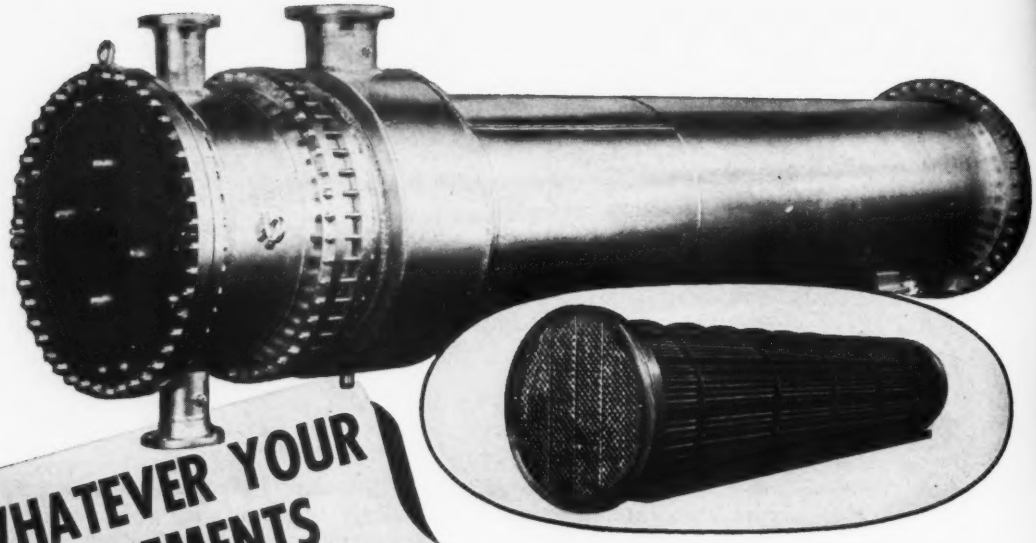

WHATEVER YOUR REQUIREMENTS for a TUBULAR HEAT EXCHANGER

You'll find an exactly suitable G-R design

- Whatever the SERVICE . . . *cooling* . . . *heating* . . . *condensing* . . . *heat exchange;*
- Whatever the OPERATING CONDITIONS . . . *pressure* . . . *temperature* . . . *capacity;*
- Whatever the FLUID . . . *liquid* . . . *gas* . . . *vapor* . . .

G-R has the right design and construction of tubular unit for every requirement, based on more than three-quarters of a century of specialized experience in building heat transfer apparatus, and the results obtained in many hundreds of thousands of installations.

G-R designs include units with floating heads, fixed heads and U-tubes . . . stationary heads with separate and integral tube sheets . . . bare and finned tubes . . . bladed, orifice, and segmental type transverse baffles . . . welded, packed and adjustable longitudinal baffles for two-pass shell . . . and various types of stationary head closures.

G-R tubular heat exchangers include exclusive features that assure leak-proof joints between passes in stationary and floating heads, lastingly tight tube joints, effective use of shell space for greatest heat transfer, convenience of inspection and lowest maintenance expense.

In addition, G-R recommendations are *impartial* as well as *authoritative*, because of the unequalled variety of heat transfer apparatus which has been developed by the G-R engineers.

This impartial, authoritative advice is offered without charge or obligation. Write for recommendations on *any* heat transfer service in which you are interested.

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Pioneers in Heat Transfer Apparatus

LUFKIN pumping units

DAY IN, DAY OUT, uninterrupted service means low operating cost and highest possible production. Trouble-free Lufkin Units have served the oil industry for more than a quarter of a century. Lufkin Units are built to exacting precision in the south's most modern and most completely equipped plant.

•

To our knowledge, Lufkin is the only full-line manufacturer of gear reducers and speed increasers. More than 60,000 gear reducers have been produced in our Lufkin plant. Send for our new gear catalog today!

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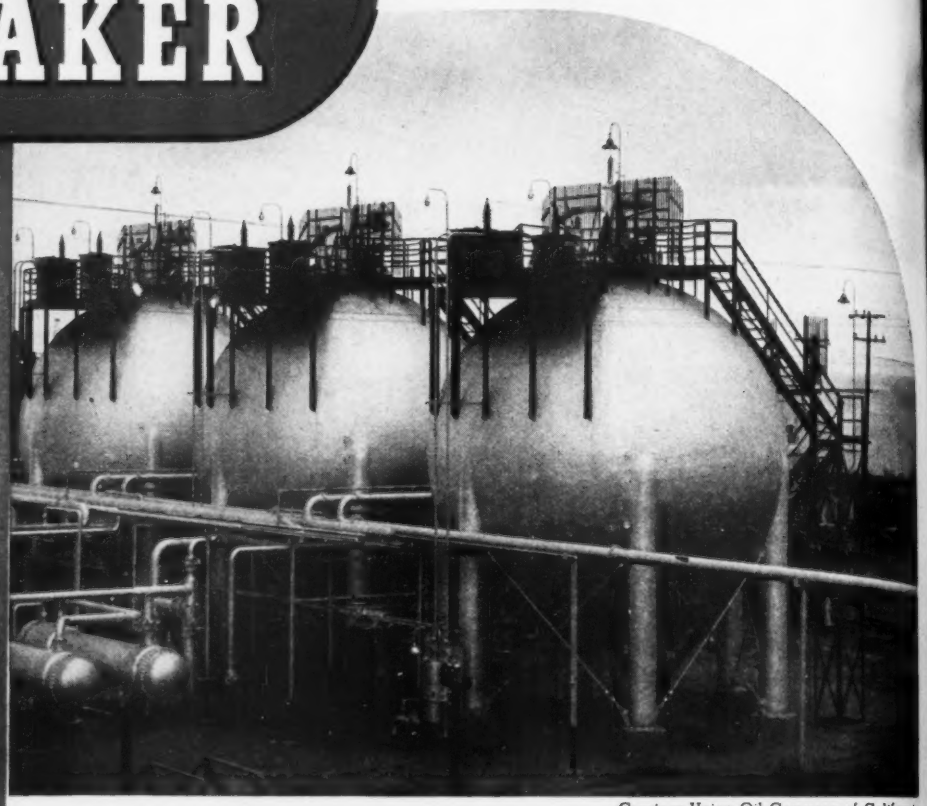
LUFKIN OIL FIELD AND INDUSTRIAL TRUCK TRAILERS

INDUSTRIAL SPEED REDUCERS AND INCREASERS

SALT SHAKER KING SIZE...



Courtesy Union Oil Company of California

A Petreco Electric Desalter doesn't exactly *shake* out the salt, but it sure gets rid of it–right now. Most Petreco desalters are getting 90% or better removal–98, 99 and 100% removal efficiencies are not unusual. Desalting eliminates the nuisance of frequent refining shut downs caused by salt plugging, hard coking and HCl corrosion. Desalting insures greater capacity, longer runs, and smoother operations. If you're having any salt difficulties, get in touch with us. We've helped some mighty good refining men shake the salt problem out of their hair. *The Petreco process is not expensive;* a Texas refiner recently figured his Petreco desalter paid off in less than six months. Get in touch with a Petreco engineer–he'll show you the figures!

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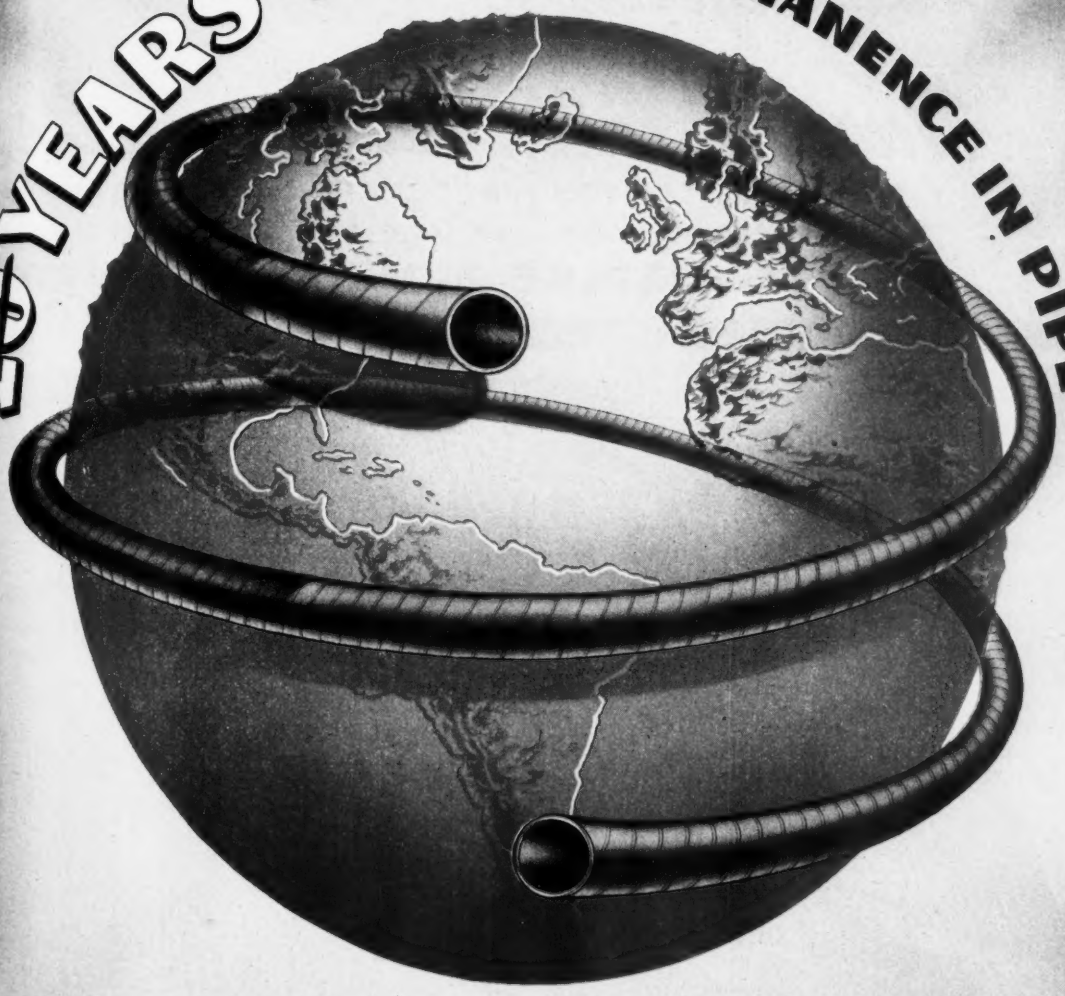
SPECIALIZED *Electric* PETROLEUM PROCESSES { DESALTING / DEHYDRATING

20 YEARS "PUTTING PERMANENCE IN PIPE"



You can't laugh off 21 years experience in doing one job well... PUTTING PERMANENCE IN PIPE. We've coated and wrapped more than 150 million feet.

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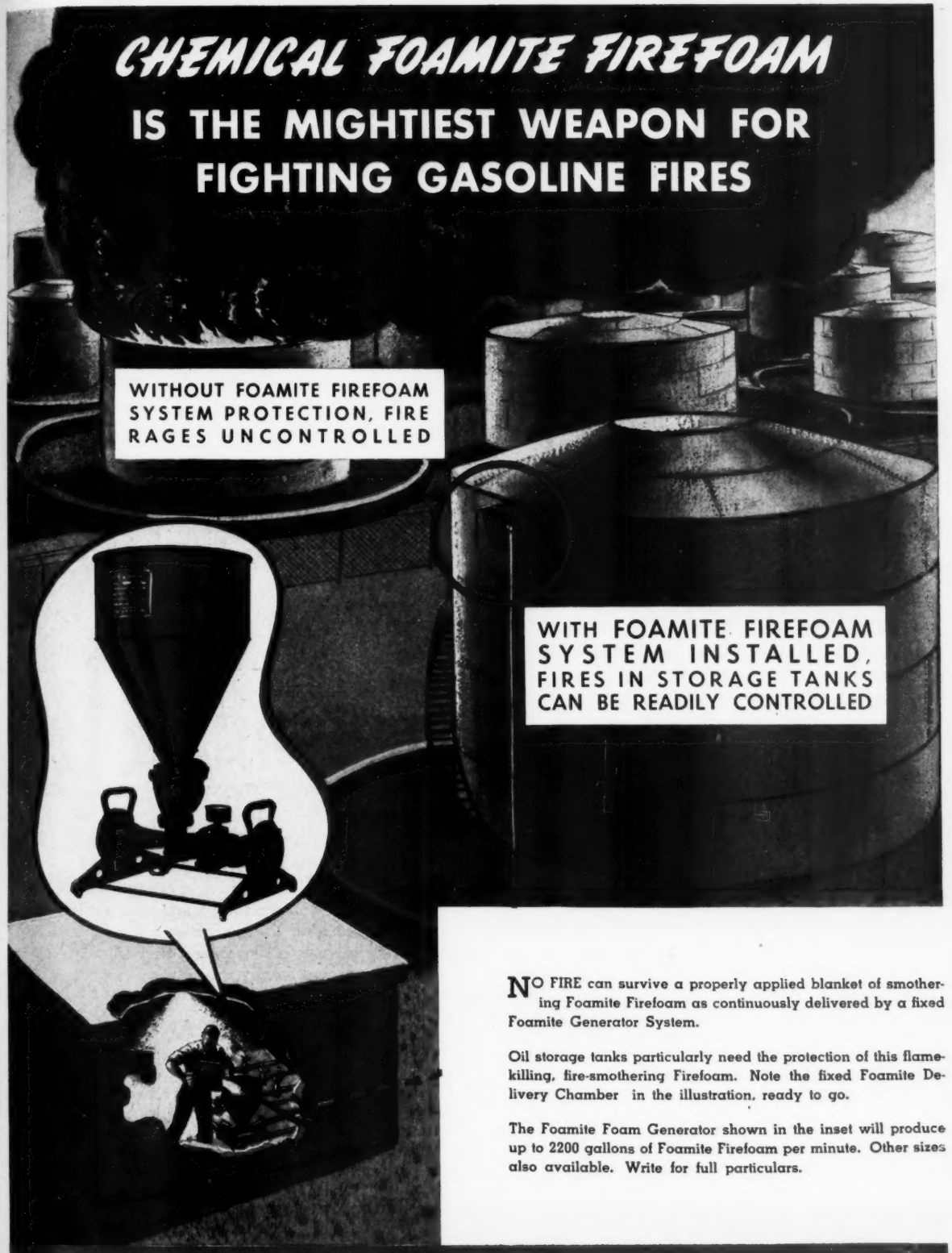
CHEMICAL FOAMITE FIREFOAM

IS THE MIGHTIEST WEAPON FOR FIGHTING GASOLINE FIRES


WITHOUT FOAMITE FIREFOAM SYSTEM PROTECTION, FIRE RAGES UNCONTROLLED
WITH FOAMITE FIREFOAM SYSTEM INSTALLED, FIRES IN STORAGE TANKS CAN BE READILY CONTROLLED

NO FIRE can survive a properly applied blanket of smothering Foamite Firefoam as continuously delivered by a fixed Foamite Generator System.

Oil storage tanks particularly need the protection of this flame-killing, fire-smothering Firefoam. Note the fixed Foamite Delivery Chamber in the illustration, ready to go.

The Foamite Foam Generator shown in the inset will produce up to 2200 gallons of Foamite Firefoam per minute. Other sizes also available. Write for full particulars.

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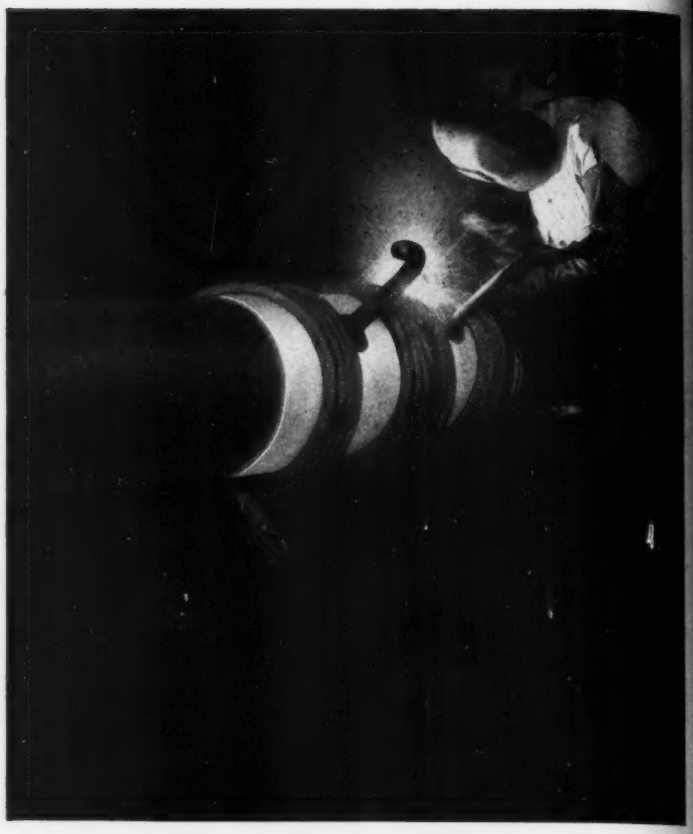

ALLOY PIPE WELDERS have to

"keep their hand in" too

Like the bakers of good homemade pies, welders of alloy piping have to "keep their hand in." Their skill must be kept sharp and up to standard by constant practice, careful following of exact procedures and regular testing.

Qualified Pipe Fabricators maintain the working conditions which attract the best men in the welding trade. These men are carefully certified, follow scientifically correct procedures, have experienced supervision and their work is frequently tested. They weld pipe continually . . . which increases their skill, broadens their understanding of alloy pipe welding-problems . . . "keeps their hand in."

Qualified Pipe Fabricators are piping specialists . . . they have the experience, skilled staffs and facilities to do a better alloy piping job. They always give you a better quality—usually save you money.

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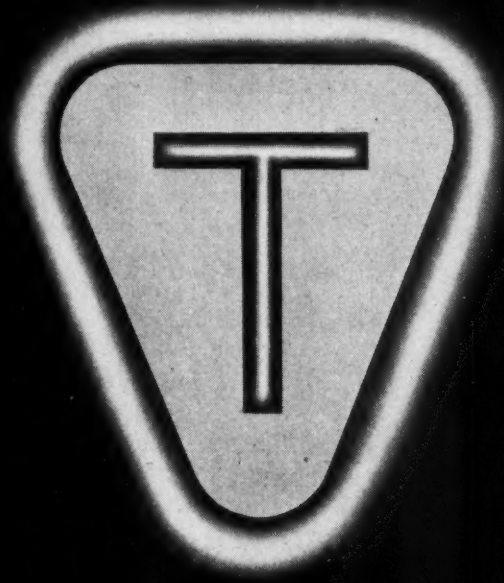
THIS IS THE TESCO HALLMARK

SYMBOL OF QUALITY STEEL CASTINGS



Now,

you'll see it on more and more STAINLESS STEEL CASTINGS

For more than 20 years, TESCO has stayed ahead of changing Gulf Coast industry demands for quality steel castings.

In keeping pace with the industrial growth and needs of this area, TESCO now makes heat and corrosion resistant castings from a pound to a ton, carefully controlled through constant laboratory analysis exactly to customer specifications.

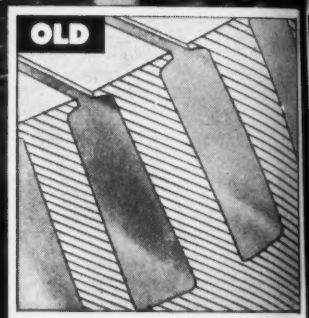
TESCO is right in the middle of the industrial Gulf Coast . . . on the spot to better service the steel casting needs of this area. The TESCO Representative and TESCO Metallurgists will be glad to discuss your stainless or carbon steel casting problems with you.

TESCO IS THE MOST EXPERIENCED FOUNDRY ON THE GULF COAST

TEXAS ELECTRIC STEEL CASTING CO.

GOOD CASTINGS — CARBON AND ALLOY STEEL — HOUSTON, TEXAS

Life-Line



Usual slot design is rectangular, with sharp corners into which slot cell insulation must be creased and coils must be pushed.

Life-Line slot design is pear-shaped. Coil slips in easily and fills slot—no corner voids remain to collect dirt and moisture.

NEW METHODS . . . NEW MATERIALS . . . OPEN WAY TO LONGER ELECTRIC MOTOR LIFE

An electric motor's "muscle" consists of the "sinews", or coils of wire, packed into slots in the stator of the motor.

If these are "bruised", or cramped or damaged while being put in—or if spaces are left for dirt or moisture to gather—protective insulation breaks down and electrical failures result. *Most motor failures are caused in this way.*

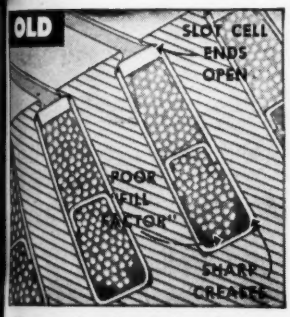
Life-Line—industry's all-steel motor—overcomes these common causes of motor failure. New, pear-shaped slots enable coils to be slipped into place without stress, eliminating need for tapping. No slot corners are left to require creasing of the slot insulation, nor to gather dirt in these voids.

New electrical design is just one of the benefits Life-Line motors bring to builders and users of motor-driven equipment. Get the details on Life-Line's smaller size, lighter weight, greater strength and smoothness.

Life-Line motors, now built in sizes from 1-15 hp, are available from stock in standard and near-standard types. "Specials" in Life-Line design are available on short shipment. Other sizes and types—up to 200 hp—soon will be changed over to modern Life-Line design. Check your nearest Westinghouse office for deliveries—or write or wire today to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

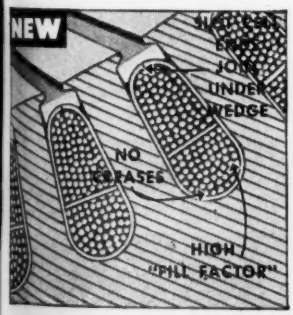
J-21456

Westinghouse PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE **Life-Line motors**

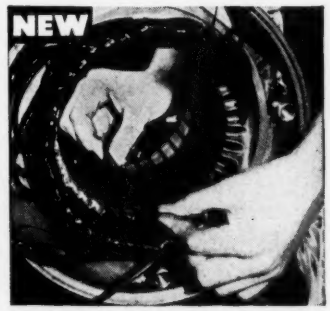


Rectangular slot design leaves many unfilled pockets for dirt, dust and moisture to accumulate and cause deterioration.

Old slot shape frequently required tapping last wires of the coil into position with resulting possible damage or weakening of insulation.



Pockets are eliminated—cell insulation is lapped over and covered by wedge. No sharp creasing of insulation is necessary.

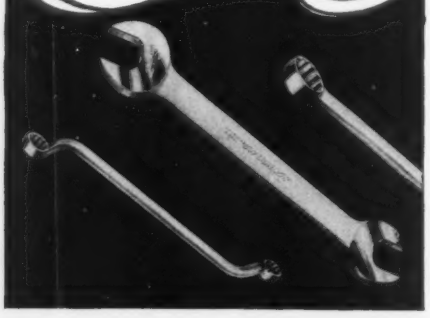


Life-Line "pear-shaped" slots permit coils to be inserted snugly into position without need for tapping or weakening of the insulation.

THE LIFE-LINE OIL WELL pumping motor has been specifically designed for exposed locations encountered in oil well pumping service. Longer life on the job with freedom from electrical failures is assured by Life-Line manufacturing methods and new insulating materials.

● Note that these Engineer's Pattern "Superrenches" are thin enough to operate jam nuts.

YOU GET
STREAMLINED
STRENGTH
WITH
WILLIAMS
"Superrenches"



Awkward, hard-to-reach adjustments present no problem for these streamlined "Superrenches". Forged from alloy steel, they are light in weight yet their strength is equal to that of the strongest wrenches made. Available in all popular patterns, with openings from 3/16" to 3-1/8". "Superrenches", with highly polished heads, are handsomely finished in durable chrome plate, over nickel.

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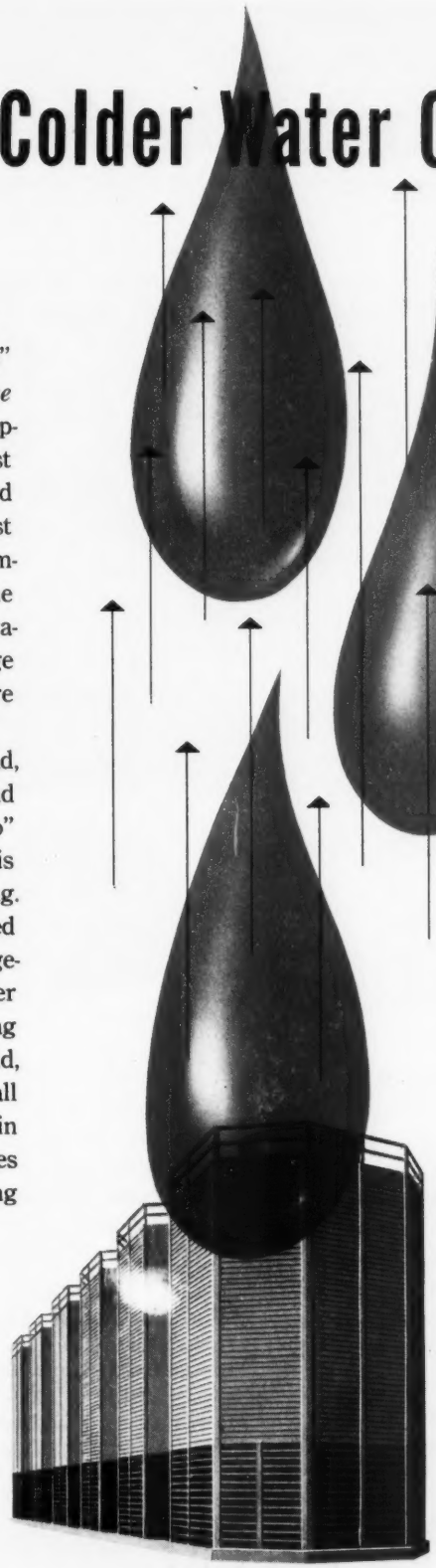
TRUE COUNTERFLOW = Colder Water Cheaper

Cheaper? Yes, and here's why: Fluor "Counterflo" Cooling Towers incorporate the principle of *true* counterflow: the air current travels directly opposite to the water current. Result? The coldest air contacts the coldest water; the hottest and most humid air (exhaust) contacts the hottest water. All the exhaust air approaches the temperature of the incoming hot water while all the cooling water approaches the wet bulb temperature of the entering air...thus taking advantage of the greatest possible terminal temperature differential so vital to efficient heat transfer.

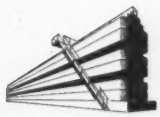
Assuming tower size, tower height, heat load, water circulation, wet bulb temperature and air quantity are equal, the Fluor "Counterflo" Cooling Tower will deliver colder water than is possible with either parallel or crossflow cooling.

The Fluor octagonal tower design; patented up-spray distribution nozzles; proper arrangement of grid decking to assure longer air-water contact; fan and gearing developed to give long service life and eliminate recirculation; rigid, time-resistant construction throughout... all add up to one net result: less operational cost in the long run. Yes, fifty years' experience proves that... year in and year out... Fluor Cooling Towers deliver colder water cheaper!

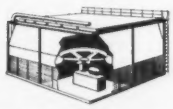


6 Cell "Counterflo" Cooling Tower

Fluor "Counterflo" induced draft cooling towers, prefabricated in mass production, are available in multiple or single units in any required size or height.



Fluor Areator atmospheric cooling towers are recommended where this type is the most practical.



The Fluor Fin-Fan cooling unit has a wide, economical range of utility throughout industry.

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PRODUCTS : *Cooling Equipment, Mufflers, Gas Cleaners, Pulsation Dampeners*

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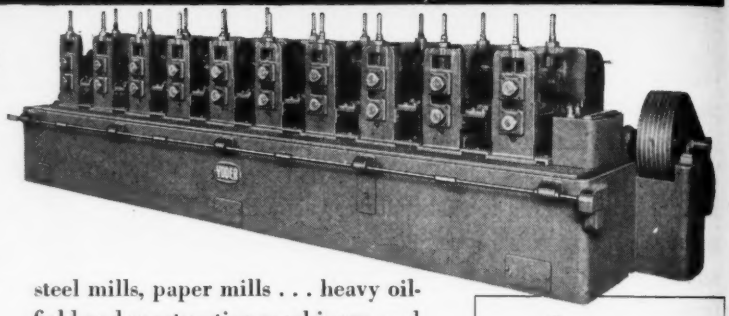
FOR ALL TYPES OF BALL AND ROLLER BEARINGS 4" BORE TO 120" OUTSIDE DIAMETER

Smooth rolling for Yoder Roll Formers

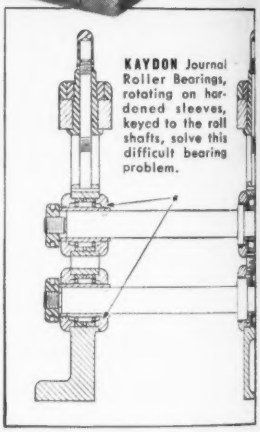


IT'S a rugged business these Yoder Roll Forming Machines are in! They take flat, heavy gauge metal strips and form them into modern moldings, tubular and angular shapes. Under the terrific loads required in the forming operations, roll shafts must operate smoothly. This calls for precision bearings of extreme ruggedness. Husky **KAYDON** Journal Roller Bearings meet these requirements.

In many types of heavy-duty machinery for metal working industries, steel mills, paper mills . . . heavy oil-field and construction machinery, and similar equipment, **KAYDON** is helping engineers to improve performance thru advanced bearing applications.

* * *

Counsel in confidence with **KAYDON**. Capacity now available for all sizes and types of **KAYDON** bearings . . . and for atmospheric controlled heat treating, precision heat treating, salt-bath and sub-zero conditioning and treatment, microscopy, physical testing and metallurgical laboratory services.


KAYDON Journal Roller Bearings, rotating on hardened sleeves, keyed to the roll shafts, solve this difficult bearing problem.

THE KAYDON ENGINEERING CORP.

KAYDON *Types of Standard or Special Bearings:*
Spherical Roller • Taper Roller
Ball Radial • Ball Thrust
Roller Radial • Roller Thrust

MUSKEGON • MICHIGAN

Here's the Aldrich "Big 3" in Pumps for the Petroleum Industry. All three were designed and built for pipe line, oil field and refinery service. One of the three should "just fit" your purpose.

The ALDRICH-GROFF "POWR-SAVR", above right, is a constant speed, variable stroke, variable capacity pump. It handles any free flowing liquid—can be automatically or manually controlled to provide stepless, straight-line variation from zero to rated maximum output. Adjustable pressures up to 15,000 psi can be maintained and variance will not exceed 2% to 5% of that desired. Power consumed is practically proportional to delivery.

The ALDRICH Inverted Vertical Quintuplex Pump, above center, can be equipped with built-in gearing (except in greater HP ratings) or with direct coupling to prime mover. This pump is ideal for use wherever large volumes of liquid must be moved against medium or high pressures.

The ALDRICH Inverted Vertical Triplex, below left, is a high pressure, constant stroke, constant speed pump. Drive arrangements can be made through gear-head motor, built-in pump gearing from extended pinion shaft, or chain, flat or V belt from extended crankshaft. Pressures up to 8350 psi can be easily maintained.

Write for complete information.

ALDRICH

THE ALDRICH PUMP COMPANY

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Long Cruise Ahead for these ROSS Lube Oil Coolers

BUILT for marine use, these rugged lube oil and jacket water coolers are of non-ferrous construction throughout.

Tubes and tube sheets are of Anaconda 30% Super-Nickel 702 with Anaconda Brass baffles. Shells are made from seamless Anaconda Copper Tubes.

Super-Nickel 702 is but one of eleven standard and several special alloys widely used in condensers and heat exchangers in the marine field, in public utility plants, petroleum refining and wherever long service under severe operating conditions is essential.

Engineers and equipment manufacturers are invited to use the broad experience and metallurgical knowledge of our Technical Department in determining the most suitable alloys for specific heat exchange requirements. For general information on Anaconda Condenser and Heat Exchanger Tubes and Tube Sheets, send for Publication B-2.

Group of completed Ross Type BCP Lube Oil and Jacket Water Coolers ready for the shipyards.
Cutaway tube bundle shows roller expanded and flared Super-Nickel Tubes in Super-Nickel Tube Sheet and heavy brass baffles. Built by Ross Heater & Mfg. Co., Inc., Buffalo, New York. 49138

ANACONDA
from mine to consumer

Anaconda

COPPER & COPPER ALLOYS

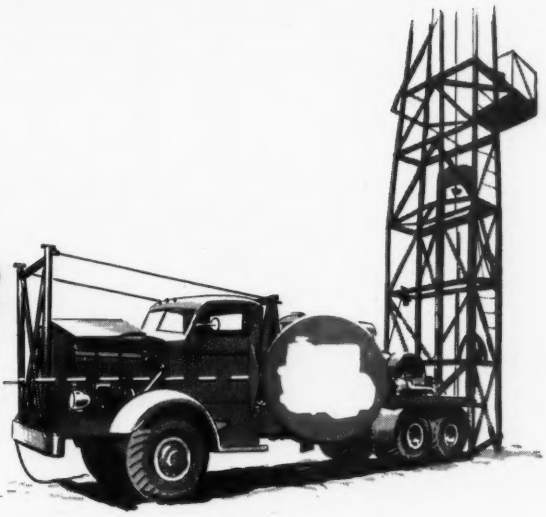
THE AMERICAN BRASS COMPANY

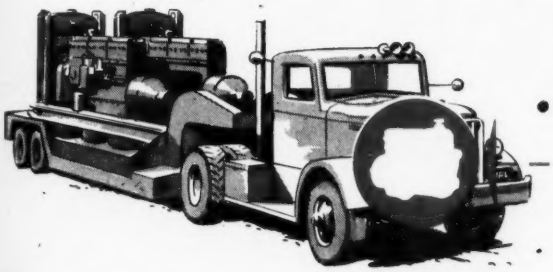
General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Watch this space





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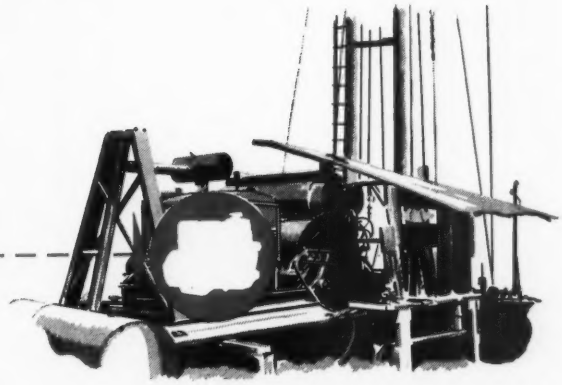


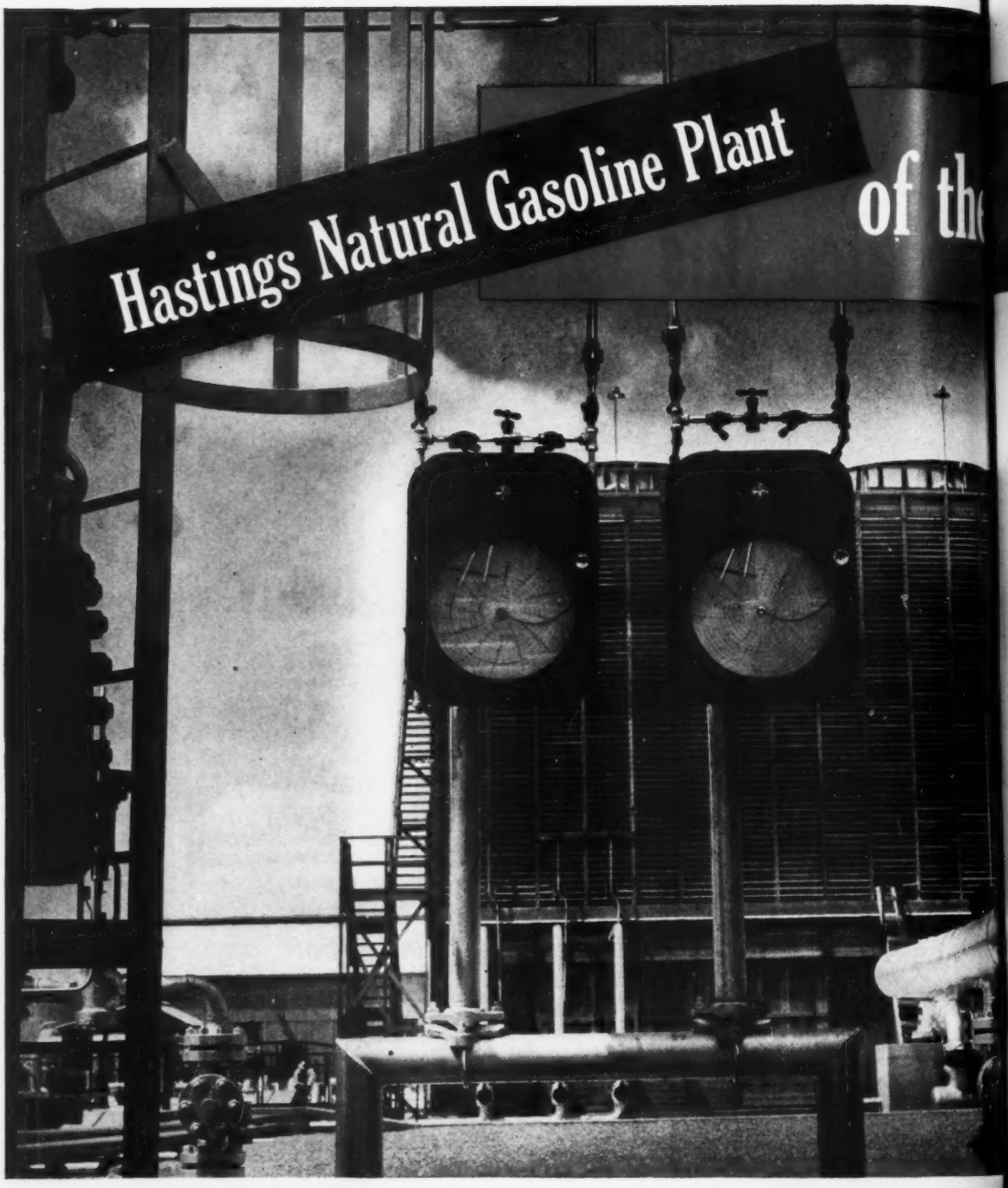
CUMMINS Diesel DIESEL

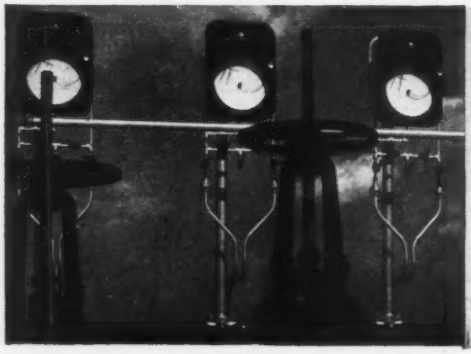
SINCE 1918...PIONEER OF PROFITABLE POWER THROUGH HIGH SPEED DIESELS

... for a new Cummins Diesel, built with the rugged simplicity of the famous "Model H" and designed to surpass its 15-year reputation for profit-making performance and economy. This is the *space to watch* next month.

CUMMINS ENGINE COMPANY, INC. · COLUMBUS, INDIANA

Hastings Natural Gasoline Plant of the Sta

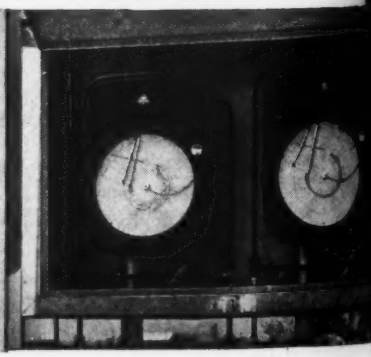




TOP: Dry gas overhead from absorbers

LEFT: Ahead of Compression. Three field mains equipped with Metric Orifice Meters deliver into a header

RIGHT: Twin Metric Orifice Meters on a Hastings lease. One for measuring wet gas from field gathering system, the other for dry gas used in field operations



Stanolind Oil and Gas Company

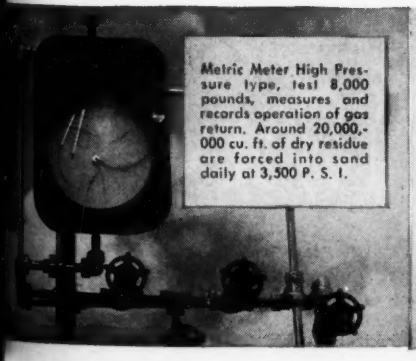
HAS INSTALLED HIGH PRESSURE METRIC ORIFICE METERS

Gas cycling and maintenance operations at the Hastings Plant call for pressures varying from slight vacuum for rich or wet gas to 3,500 P.S.I. when dry gas is pumped into the wells for gas lift and conservation purposes.

Efficient operation of this plant with a daily throughput of 35,000,000 cu. ft. calls for measuring instruments of highest accuracy and dependability.

Metric Orifice Meters are effectively serving the exacting requirements of this plant at Hastings. The California Company's Lake St. John and Cranfield Plants; Shell's Sheridan Plant; Humble's Katy, Tom O'Connor, Anahauc, Clear Lake Plants, and others are demonstrating the suitability of Metric Orifice Meters for high pressure applications up to 5,000 P.S.I.

WRITE FOR FULL INFORMATION



Metric Meter High Pressure type, test 8,000 pounds, measures and records operation of gas return. Around 20,000,000 cu. ft. of dry residue are forced into sand daily at 3,500 P. S. I.

AMERICAN METER COMPANY

INCORPORATED (ESTABLISHED 1836)

Albany • Atlanta • Baltimore • Birmingham • Boston • Chicago • Dallas
Denver • Erie • Houston • Joliet • Kansas City • Los Angeles • New York
Odessa • Orlando • Philadelphia • Pittsburgh • San Francisco • Tulsa

TIMKEN CARBON STEEL TUBING
Generally for service not exceeding 900°F. where corrosion and oxidation resistance are not important.

TIMKEN CARBON-MO STEEL TUBING
For temperatures up to 1000°F. Improved creep strength makes it safer than carbon steel.

TIMKEN DM STEEL TUBING For service up to 1150°F. This steel offers outstanding creep strength.

TIMKEN 2% CR ½% MO STEEL TUBING For service up to 1150°F. Intermediate corrosion resistance plus good creep strength, fair oxidation resistance.

TIMKEN SICROME 2 STEEL TUBING
For service up to 1200°F. where better scale resistance is required than can be obtained with 2% Cr. ½% Mo. Steel.

TIMKEN 2¼% CR-1.0% MO STEEL TUBING For service up to 1150°F. Has greater resistance to creep than 2% Cr. ½% Mo. Steel.

Look here for a better LIFE / COST ratio for your tubes

TIMKEN SICROMO 3 STEEL TUBING
For service up to 1200°F. Has excellent oxidation resistance and good corrosion resistance.

TIMKEN 4-6% CR MO STEEL TUBING
For service up to 1200°F Superior corrosion resistance. Less oxidation resistance than Sicromo 3.

TIMKEN SICROMO 5 S STEEL TUBING
For oxidation resistance to 1500°F. Good creep strength and corrosion resistance to 1300°F.

TIMKEN SICROMO 7 STEEL TUBING
For applications requiring better corrosion resistance than can be obtained with 5% Chromium type steels.

TIMKEN SICROMO 9 M STEEL TUBING This steel possesses the maximum corrosion resistance of any of the steels below the stainless group.

TIMKEN 18-8 STEEL TUBING Shows the best combination of creep strength, oil corrosion resistance and oxidation resistance up to 1500°F.

HERE are 12 of the high temperature steels developed by The Timken Roller Bearing Company to help you get the best life/cost ratio for your particular operating conditions. Each is designed to solve specific problems of heat, pressure, corrosion, and oxidation . . . at lowest possible cost.

But which one is best for *you?*

Let the metallurgists of the Timken Company analyze your high temperature tube problems. With 19 years of experience and research, plus a wide selection of Timken fine alloy steels at their disposal, they can recommend the steel that will do your job most efficiently.

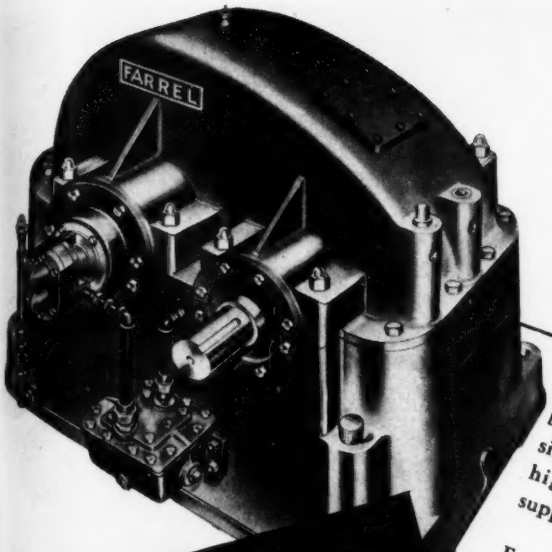
That way, you're sure your steel has the most suitable combination of properties to give satisfactory life. You're also sure you are investing no more in the tubes than you actually need to for your operation.

Whichever analysis is selected, every shipment of Timken tubes will give you uniform high quality performance. This uniformity is assured by the Timken Company's close quality control from melting through final tube inspection.

For help in selecting the best high temperature tubes for *your* job, call upon our Technical Staff. No obligation. Write, The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.



ANY SPEED RATIO YOU REQUIRE . . . from 1:1 to 40:1

SINGLE STEP-UP UNITS
Speed Ratios 1:1 to 12:1

Farrel speed increasing units are available in 49 standard sizes with speed ratios ranging from 1:1 to 12:1. For higher ratios, units using two sets of gears are supplied with ratio range from 12:1 to 40:1.

Farrel Type SI Units were the first to be developed in a standard series for pipe line pumping service. That was sixteen years ago, and all of the original units installed at that time are still in operation, performing as well as on the day they were put into service.

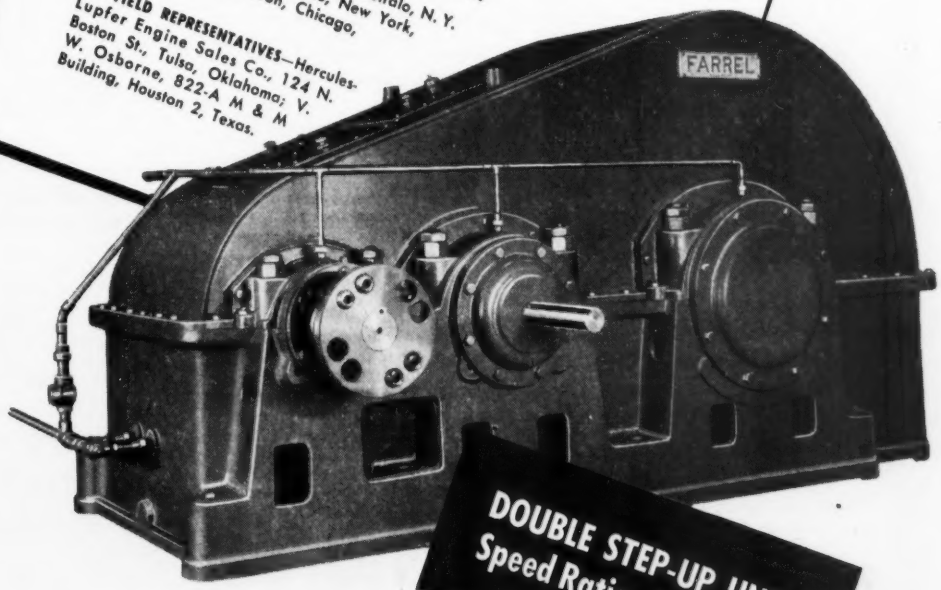
Before you specify gear units, look into the many advantages of the Farrel design. For full information send for new Bulletin No. 448. No obligation.

FARREL-BIRMINGHAM COMPANY, INC.
344 VULCAN ST., BUFFALO 7, N. Y.

FB—440

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Chicago, Los Angeles

OIL FIELD REPRESENTATIVES—Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa, Oklahoma; V. W. Osborne, 822-A M & M Building, Houston 2, Texas.



DOUBLE STEP-UP UNITS
Speed Ratios 12:1 to 40:1

1848 FARREL CENTENNIAL 1948

Farrel-Birmingham

Your choice of 1, 2, 3, or 4-lamp

Fluorescent Lighting Fixtures in the complete CROUSE-HINDS line . . . . designed to meet your requirements

EASY INSTALLATION

Crouse-Hinds Explosion-Proof Fluorescent Lighting Fixture CONDULET* has a novel hinge connection between the lamp receptacle housing and the ballast housing that makes it unnecessary to raise and attach both ends of the fixture at the same time. With the tubes hanging straight down, the ballast end is connected to the supporting CONDULET. Then the relamping end is raised and attached, bringing the tubes to a horizontal position.

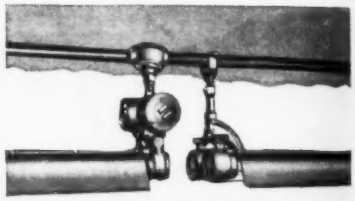
EASY MAINTENANCE

Relamping is a quick and easy one-man job. No special tools are required. Moving a link in the supporting stem assembly permits one end of the fixture to be lowered so that the lamp can be withdrawn. After relamping, simply lifting the lowered end automatically locks the fixture in its normal position. Saves time and money on maintenance.

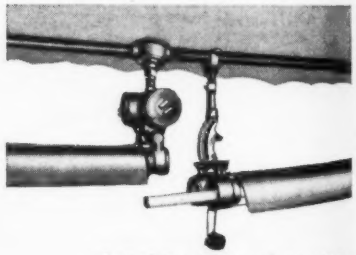
QUALITY CONSTRUCTION

The ballast and lamp receptacle housings are of cast aluminum with unobstructed threaded covers to allow easy access to the interior. Each lamp is housed in an individual heat-resisting glass tube. The ballast housing is entirely exposed, resulting in a low operating temperature. The durable white enameled sheet steel reflectors are securely attached by spring clips. No tools are required to put them on or take them off after the fixture has been hung.

Write for full details on this modern Explosion-Proof Fluorescent Lighting Fixture CONDULET.



Type EVF Explosion-Proof Two-Lamp Fluorescent Lighting Fixture CONDULETS Installed in Line Close Together



End of One Fixture Lowered for Relamping, One Cover Removed and Lamp Partly Withdrawn

Takes standard 40-watt, 48-inch lamps.

*CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle St. Louis — Washington. *Resident Representatives:* Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS
FLOODLIGHTS
TRAFFIC SIGNALS
AIRPORT LIGHTING

Homestead

LEVER-SEALD Valves

ALWAYS WORK
LAST LONGER
COST LESS PER YEAR

STICKING valves are never a problem with Homestead Lever-Sealds on the job. Built into each valve is a powerful leverage, ready at all times to overcome the effects of corrosion, viscous fluids or temperature and pressure extremes which cause ordinary valves to stick or "freeze."

This powerful leverage not only relieves pressure between the seating surfaces to permit operation under all conditions; but it also is the means of providing the extra tight seal against leakage—the seal which keeps corrosive or erosive line fluids away from the seating surfaces; assures longer valve life and lowest cost per year.

Made in stainless steel, steel, semi-steel, bronze, monel or other alloys suitable for the working conditions under which they are to be used, Homestead Lever-Seald Valves may be had in sizes from 1" to 12"; and for working pressures from 150 pounds to 1500 pounds.

Choose the sizes and types for your services from Reference Book 39 Section 3. Write for your free copy today.

Check these Outstanding Features:

A QUARTER-TURN fully opens or closes valve.

INSTANT STICK-PROOF OPERATION. Plug turns freely after seating pressure is relieved by screw lever.

POSITIVE LEAKLESS SEAL is obtained by applying full seating pressure with screw lever after opening or closing.

LEAK PROOF. Deep stuffing box, gland and sealed bottom prevent fluid loss, and reduce hazards.

STRAIGHT-LINE FLUID FLOW. Little or no pressure drop.

SEATING SURFACES ALWAYS PROTECTED in both open and closed positions. Fluid or grit cannot damage valve seat.

HOMESTEAD VALVE MANUFACTURING CO.

P. O. BOX 403 CORAOPOLIS, PENNA.

OVEN TEST COOKS UP LONGER LASTING PRODUCTS

QUAKER PRE-TESTED PRODUCTS FOR THE PETROLEUM INDUSTRY ARE PERFORMANCE-PROVED THROUGHOUT THE NATION

It may be called the "Oven Test," but to the buyer of Quaker Rubber Products it means producing rubber with the ability to withstand heavy static loads.

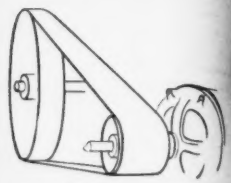
In making Quaker Rubber Hose it results in compounds of controlled specifications that will hold couplings over long periods of time . . . prevent hose from relaxing and allowing couplings to loosen. In packings, this pre-testing assures finished products that will hold their shape, will not relax, readily withstand pressures without the danger of blowouts.

This is only one of eighteen rigid tests that raw materials and finished products *must* pass before receiving the Quaker stamp of approval. Pre-testing provides quality and long service . . . assures worthwhile dividends for you through higher plant efficiency, lower operating costs. Call in your nearest Quaker distributor for hose, belting and packings.

QUAKER RUBBER CORPORATION

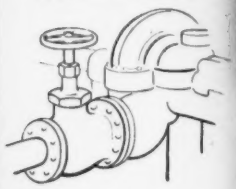
PHILADELPHIA 24, PA. • New York 7 • Cleveland 15 • Chicago 16 • Houston 1
Western Territory
QUAKER PACIFIC RUBBER CO. • San Francisco 10 • Los Angeles 21 • Seattle 4

WHAT QUAKER Pre-Tested Products mean to Petroleum Industry



STEADY GRIP . . . LESS SLIP

Quaker V-belts and flat belting are pre-tested to provide plenty of grip, plenty of pull for more power. Pre-tested rubber stays flexible, withstands aging and abrasion.



TIGHT-SEALING OPERATION

Quaker pre-tested packings for all purposes keep pressure in . . . stop leaks on valve stems, piston rods, flanges. Made of pre-tested materials for long life.

LONG SERVICE AT HIGH PRESSURE

Quaker hose provides low-cost handling of steam, air, liquids, volatiles. Pre-tested rubber remains pliable, flexes easily, combats breakdown.

•

ENGINEERING SERVICE

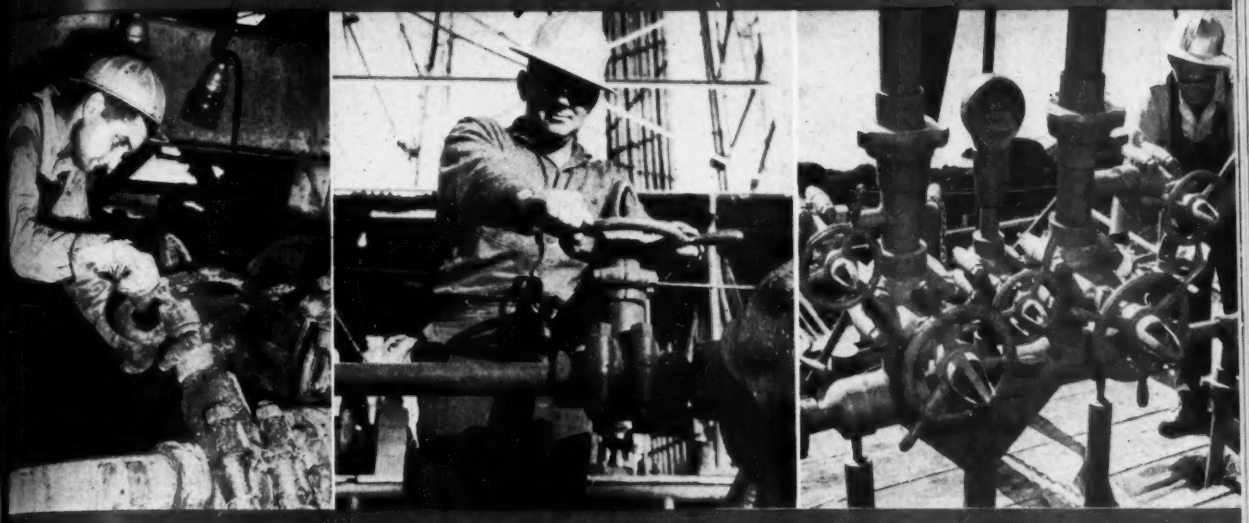
When belting, hose, and packing problems bog down efficiency in your plant, call your Quaker Distributor for a quick solution.

QUAKER RUBBER CORPORATION · PHILADELPHIA, PA. · QUALITY SINCE 1885 · REG U S PAT OFF

QUAKER RUBBER PRODUCTS
custom made for every industrial use

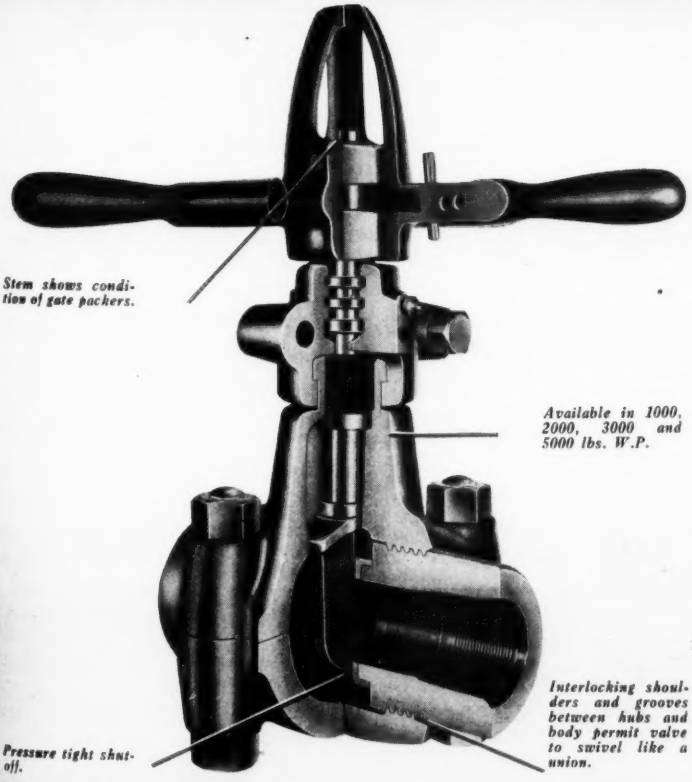
LONG AFTER THEY HAVE PAID FOR THEMSELVES

(THROUGH REDUCED MAINTENANCE)



Cameron "Flex-Seals"

Go on Sealing... and Saving



Stem shows condition of gate packers.

Available in 1000, 2000, 3000 and 5000 lbs. W.P.

Interlocking shoulders and grooves between hubs and body permit valve to swivel like a union.

Pressure tight shut-off.

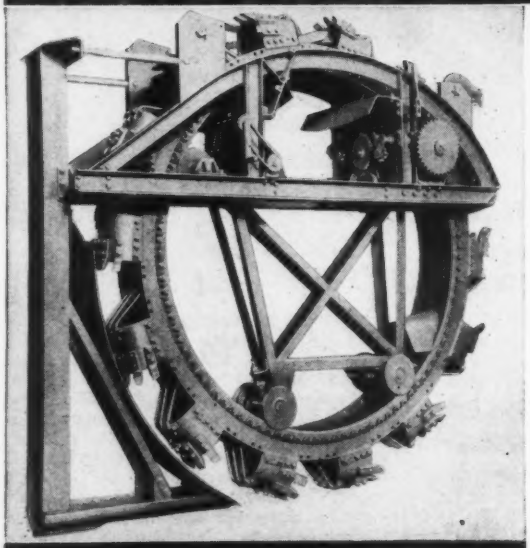
The design of Cameron "Flex-Seal" Mud Line Valves provides a renewable resilient Flow-way insert which slowly absorbs the abrasive and erosive mud action and continues to effect a pressure-tight seal until the reserve of resilient material is depleted. (See cut.) When finally worn out, the flow-way insert, which costs only a few dollars, can be quickly and easily replaced in the field with ordinary rig tools by any member of the drilling crew. Renewable steel wear rings protect the hub ends against cutting. The slow-wearing heat-treated steel gate seldom needs replacement because the resilient insert readily flows to a seal around the gate even when it is substantially sand cut.

Cameron "Flex-Seals" are the only valves designed expressly for mud line service. Try them on your rig for a first-hand check on their long life, economy and operating features.

CAMERON
IRON WORKS, INC.
P. O. BOX 1212, HOUSTON, TEXAS

Export: 74 Trinity Place, New York, N. Y. Oklahoma: 310 Thompson Bldg., Tulsa (Telephone 28970). California: Long Beach (P. O. Box 267). Wyoming: 356 N. Wolcott St., Casper. North Louisiana: Bossier City (P. O. Box 425). Texas: Midland (Telephone 1982), Corpus Christi (Telephone 28783), Ft. Worth (Telephone 46522).

For TOP SPEED... on trenching



Crumber attachment and leveling shoe pick up and return fines to bucket line . . . sweep trench bottom clean, ready for pipe. Standard on 200 pipeline Trenchliner. Note, too, how heavy-duty wheel frame firmly supports digging wheel and spoil conveyor. Strong steel channels and angles make frame resistant against distortion.

Parsons WHEEL TRENCHLINER*

You can set a fast pace for your pipe gang with a Parsons 200 wheel Trenchliner on the job. It digs as fast as 20' per minute . . . trenches 15" to 26" wide, up to 5'-6" deep . . . delivers clean, smooth-walled, round-bottomed trenches ready for pipe without extra cost of hand trimming.

Production stays high, costs low, because this pipeline Trenchliner is built big and rugged in every detail. Heavy-duty wheel is held firmly at bottom, where digging pressure is greatest . . . arched wheel frame rigidly supports both digging wheel and conveyor, keeps wheel precision-aligned for accurate grading. Main operating gears are fully enclosed . . . run in continuous oil baths . . . give you longer, trouble-free service.

Parsons Trenchliners are also available in 3 other heavy-duty sizes. Let your Parsons distributor show you what one of these big production Trenchliners can do for you. In Texas see ALAMO IRON WORKS, San Antonio . . . BARTHOLOW MACH. CO., Dallas . . . GOODMAN BROS., Midland . . . F. S. RAY CO., Houston. In Oklahoma see CLARENCE L. BOYD CO., Tulsa and Guthrie. You'll find Parsons distributors in all other major oil field centers, as well.

*Trademark Reg. U. S. Pat. Off. KP827

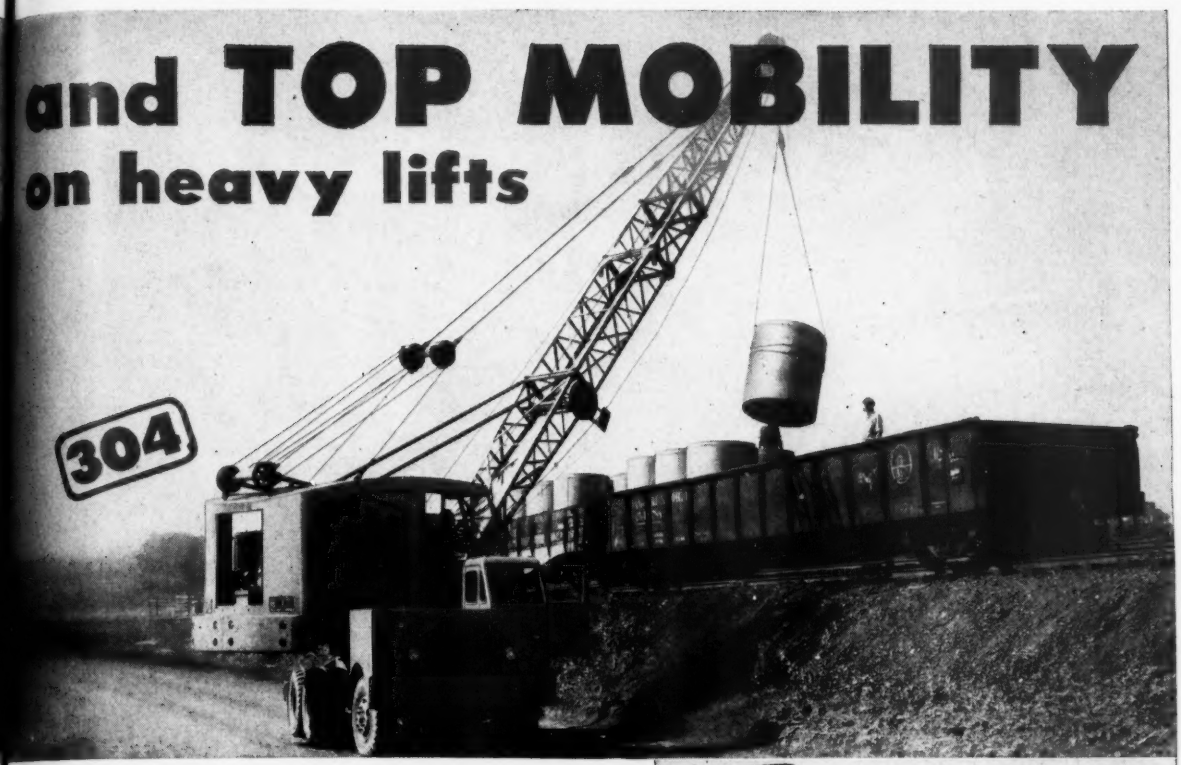
PARSONS HEAVY DUTY

The PARSONS COMPANY

Koehring Subsidiary

Newton, Iowa

and TOP MOBILITY on heavy lifts



Koehring TRUCK CRANES

Where you have heavy lifting jobs of short duration, scattered over a wide area, you can get top mobility with Koehring truck-mounted cranes. They roll between jobs at speeds up to 35 MPH . . . with no time lost for trailer mounting. Wide range of working and traveling speeds is also an important time-saver when moving on the job with a load.

You get plenty of stability to handle bigger lifts safely because they're built heavy and tough throughout to meet rugged oil field service. Ease of operation gives you top performance every shift. Ready accessibility of all machinery simplifies maintenance, means less down-time, more work-time.

Simple convertibility from crane to shovel, pull shovel, dragline, clamshell or pile driver extends the speed, mobility and economies to all your materials-handling jobs. Let your Koehring distributor show you how. In Texas it's ALAMO IRON WORKS, San Antonio . . . BARTHOLOW MACH. CO., Dallas . . . GOODMAN BROS., Midland . . . F. S. RAY CO., Houston. In Oklahoma see CLARENCE L. BOYD CO., Tulsa and Guthrie. You'll find Koehring distributors in all other major oil field centers ready to serve you, as well.

A size to suit every job:

Koehring 205 — Shovel, Pull Shovel — ½ yard Crane Lifting Capacities: Crawlers: 13,800 lbs. Truck: 20,000 lbs.

Koehring 304 — Shovel, Pull Shovel — ¾ yard Crane Lifting Capacities: Crawlers: 23,100 lbs. Truck: 40,000 lbs.

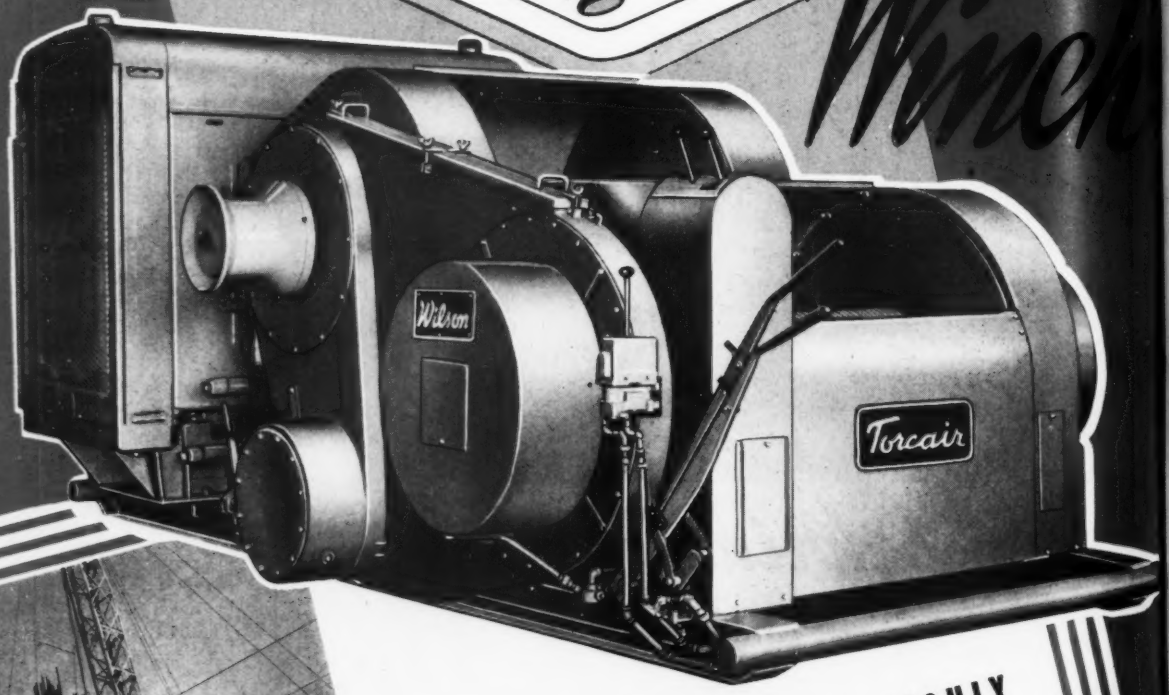
Koehring 605 — Shovel, Pull Shovel — 1½ yard Crane Lifting Capacity: Crawlers: 60,760 lbs.

Crawlers: 75% Rating — Truck: 85% Rating.

KOEHRING HEAVY DUTY

KOEHRING COMPANY
Milwaukee 10, Wis.
Subsidiaries: JOHNSON • KWIK-MIX • PARSONS

THE Wilson Torcair Winch

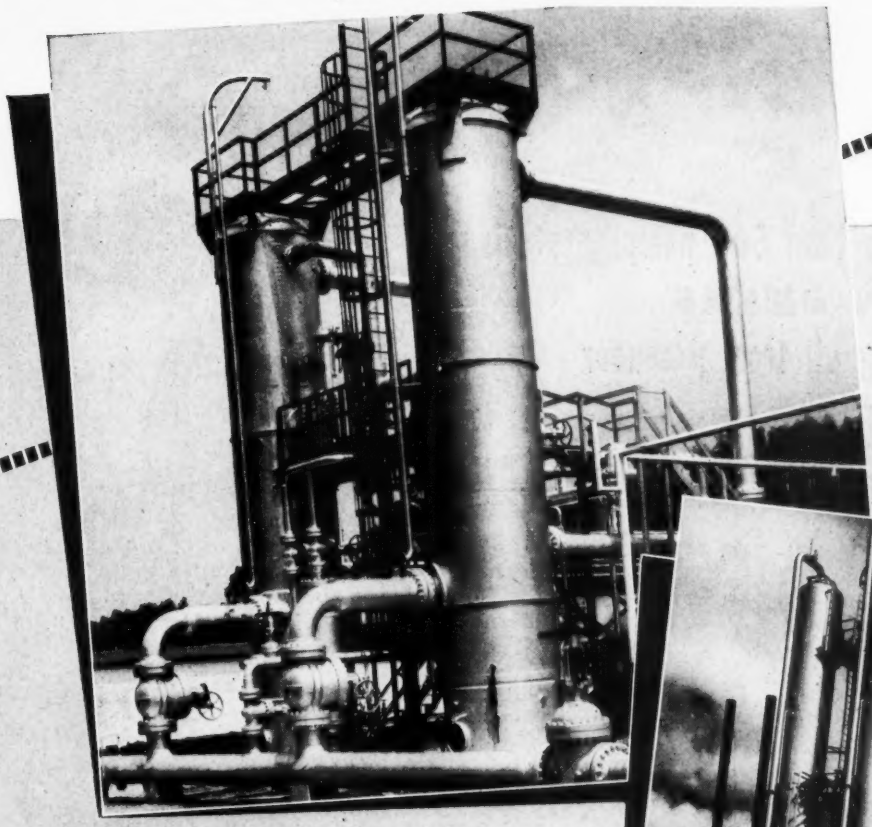


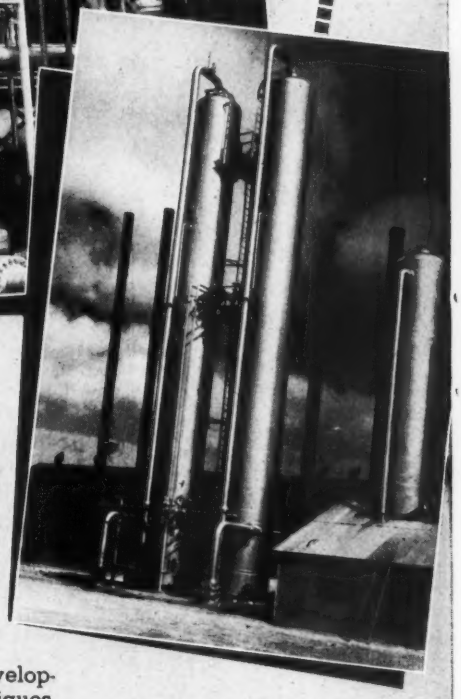
DESIGNED TO PROVIDE A HIGHLY FLEXIBLE CONTROL USING TORQUE CONVERTER DRIVE and AIR CLUTCHES

The Wilson TORCAIR Winch is probably the most modern and highly refined winch on the market today. Available in two sizes . . . the SUPER, recommended for wells up to 6,000′ with 2½″ tubing, and the MOGUL, without the hydromatic brake recommended for wells up to 8,000′ with 2½″ tubing, and for wells up to 16,000′ with 2½″ tubing when equipped with 15″ double rotor hydromatic brake and engines of suitable power. Both models are made in single or double drum type, and all winches are equipped with Wilson Air-Tube Disc Clutches on both drums with high and low speeds on main drum and one friction clutch speed on the upper or sand line drum. Available with 90′ or 96′ Mast and trailer mounted as shown. The last word in deep well servicing units. WRITE FOR BULLETIN GIVING COMPLETE DETAILS AND SPECIFICATIONS.

Wilson MANUFACTURING CO., INC.
WICHITA FALLS • TEXAS

PACIFIC COAST DISTRIBUTOR: POWER RIG & EQUIPMENT CO. • LOS ANGELES, CALIFORNIA
EXPORT AGENTS: GUY E. DANIELS • 30 ROCKEFELLER PLAZA • NEW YORK CITY





Actual Experience Proves Again and Again,

PRITCHARD **GAS ENGINEERING***

SERVICES CAN SAVE YOU MONEY!

There can be no substitute for the experience J. F. Pritchard & Co. has acquired in designing and constructing gas handling facilities. You, too, are invited to obtain the practical benefits that are the result of incorporating new developments, modern equipment and proven gas engineering techniques into your plans and plants.

You are cordially invited to write for a complete list of natural gas facilities engineered by Pritchard—two of which are illustrated above. Then put Pritchard to work on your next job. Preliminary estimates furnished without obligation.

THREE FUNCTIONS—Engineering, Construction, Manufacturing—

In FIVE FIELDS—Serving the CHEMICAL, GAS, PETROLEUM and POWER industries as well as providing specialized EQUIPMENT for all industries.

*These Pritchard GAS ENGINEERING Services Are Available to You

- Compressor stations, additions
- Pressure maintenance units
- Dehydration, solid or liquid
- Desulphurization, amine type
- Conditioning and treating
- L.P.G. installations
- Hydrocarbon dew point control
- Cooling and heat transfer
- Removal of liquids and dust

NATURAL GAS DIVISION

J.F. Pritchard & Co.

DESIGN • ENGINEERING • CONSTRUCTION

908 GRAND AVE. • KANSAS CITY 6, MO.

Houston • New York • St. Louis

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"In more than 500 pumping stations
BALDWIN DIESELS
are speeding oil from producer
to consumer"

BALDWIN PRODUCTS
FOR THE PETROLEUM INDUSTRY

Diesel engines; Hydraulic pumping jacks; Locomotives; Steel castings and forgings; bronze and iron castings; bearing metals; weldless rings; rolled steel flanges.

BALDWIN

The Baldwin Locomotive Works, Philadelphia 42, Pa., U.S.A. Offices: Boston, Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington.

THERE'S NO SUBSTITUTE FOR EXPERIENCE

HAMMOND STORAGE WORKS

CONE ROOF
FLOATING ROOF
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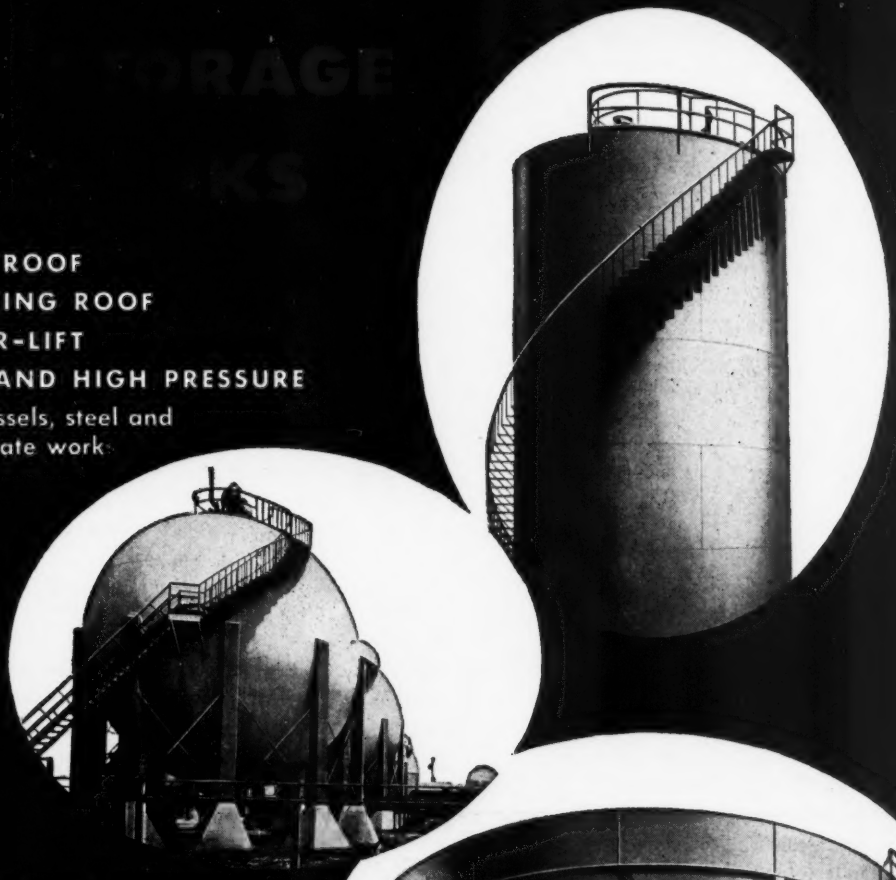
LOW AND HIGH PRESSURE
also vessels, steel and alloy plate work



HAMMOND designs, fabricates and erects tanks of all types for liquid and dry storage . . . above or below ground . . . high or low pressure . . . cone roof . . . HAMMOND SPHERE . . . floating roof . . . VAPOR-LIFT . . . spheroid . . . GLOBE ROOF PRESSURE . . . gas holder . . . also stainless and stainless-clad vessels of all types and designs for the petro-chemical industries

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WARREN, PA. and PORT NECHES, TEX.

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GOOD HAUL ROADS *pay!*

build and maintain 'em faster, easier with the NEW, heavy-duty Allis-Chalmers model AD-4 motor grader

EVERYTHING YOU WANT IN A MOTOR GRADER

POWERFUL—104 brake hp.

STRONG—exclusive tubular frame to withstand shocks; protects control rods, too.

HEAVY—22,140 lbs. effective weight.

ACCURATE—blade held on work through direct down pressure.

HIGH CLEARANCE—over 30" throat clearance for handling bigger windrows.

"ROLL-AWAY" MOLDBOARD—material is rolled not pushed, requires less power.

PLUS Full Circle Revolving Blade, Full Range of Blade Positions, Electric Brakes, Easier Steering, Larger Clutch, Electric Gauges, Full Visibility and many other outstanding advantages.

Good oil field roads, kept constantly smooth, pay through quick, safe delivery of supplies and fast shipment of raw and finished products . . . and by keeping trucks on the job instead of in the repair shop. Trucks last longer, too, and maintenance is kept at a minimum.

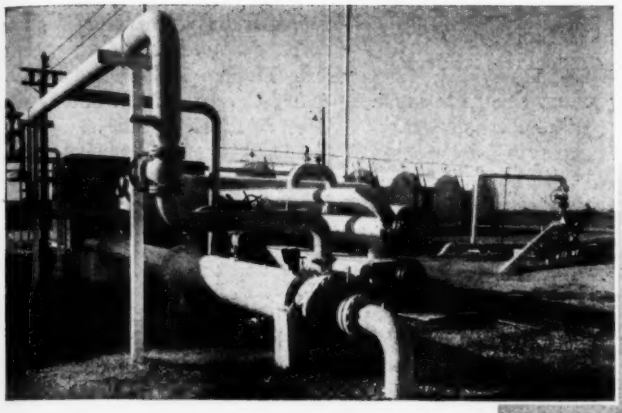
As in construction, mining and logging, oil field operators also find it pays to use motor graders to build and maintain haul roads. Especially designed for grading, they do the work faster, better, at lower cost . . . are ideal for scarifying and handy for many pulling jobs.

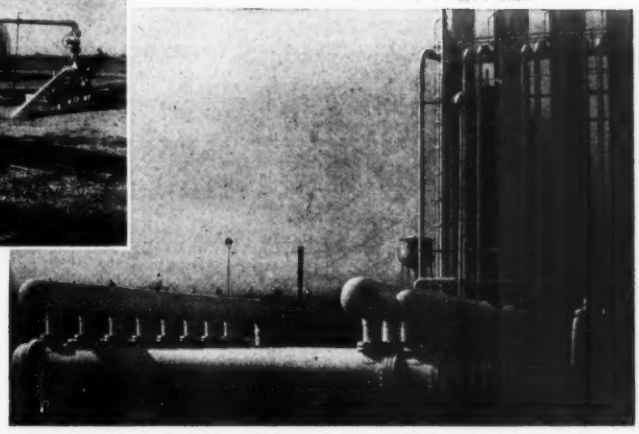
Through its long experience in manufacturing construction equipment, Allis-Chalmers has developed a motor grader that fully meets every operator and owner requirement. The new Model AD-4 provides outstanding power and strength, ease of operation and earth-moving capacity. Look over its many advantages . . . then see your Allis-Chalmers dealer. It would be wise to place your order NOW!

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Universally accepted for

VERSATILITY,
ECONOMY,
RELIABILITY





Typical of Western field installations is the Telescopic Jacket Water Cooler, left, at Phillips Petroleum Products pump station, Cassaday, Kansas; and, right, Floating Head Gas Coolers at Panhandle Eastern Pipe Lines Liberal, Kansas, station.

WESTERN HEAT EXCHANGERS

Pipeline companies throughout the oil industry, like refiners, manufacturers and processors, look to Western for an efficient, economical solution to their heat transfer problems.

Our Engineering Department is at your disposal for consultation on the application of specific heat transfer requirements to your particular need.

Now AVAILABLE

Western's newly-published, informative booklet on Heat Transfer Problems, Materials and Methods. A copy of this valuable publication is yours upon request.

WESTERN SUPPLY CO.

P. O. Box 1888 — TULSA, OKLAHOMA — Phone: 8211 - L.D. 243

Drills turn easier, thrust problem solved, with rotary table on Timken® bearings

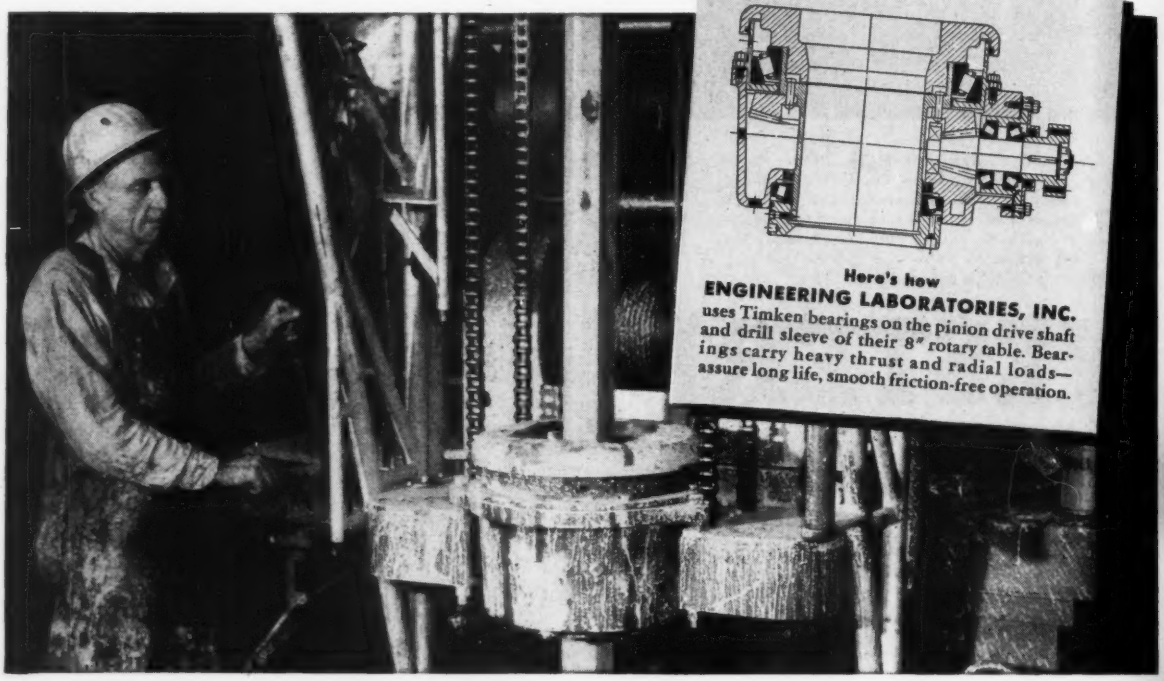
TO cope with the heavy radial and thrust loads encountered in rotary drill tables, Engineering Laboratories, Inc., Tulsa, Oklahoma uses Timken tapered roller bearings at the main position, lower position and on the pinion shaft of the 8″ rotary table of their M-7 portable oil field drilling machine. Result: drills turn easily, smoothly, efficiently, economically.

Because their tapered construction enables them to carry any combination of radial and thrust loads, Timken bearings are made to order for jobs like this. The line contact between the rolls and races gives tremendous load-carrying capacity. Precision manufacture and finishing to almost incredible smoothness results in free-rolling motion that practically eliminates friction, even under the heaviest loads.

Timken bearings are made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel. Wear is negligible and Timken bearings normally last the life of the machine. Effective closures can be used to keep lubricant *in*, dust and dirt *out*.

Timken bearings in any product add a valuable sales feature. Be sure you have them in any machine you build or buy. Look for the trademark "Timken" on the bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



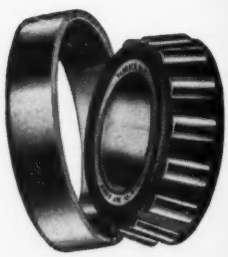
Here's how
ENGINEERING LABORATORIES, INC.
uses Timken bearings on the pinion drive shaft and drill sleeve of their 8″ rotary table. Bearings carry heavy thrust and radial loads—assure long life, smooth friction-free operation.

TIMKEN BEARING
CAPACITY RATINGS INCREASED 25%.

Since Timken bearings were last re-rated some 15 years ago there has been such a further and constant improvement in quality that we are now able to announce a 25% increase in radial and thrust load carrying capacity. This may make possible the use of smaller bearings with savings in bearing cost, material cost and weight. Engineers will be able to utilize the advantages of Timken bearings in more applications than in the past.

A new Timken Engineering Journal, now in preparation, will give you complete capacity rating tabulations. For further assistance, write us today.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ◫ AND THRUST ◫→ LOADS OR ANY COMBINATION ✳

PITTSBURGH-DES MOINES

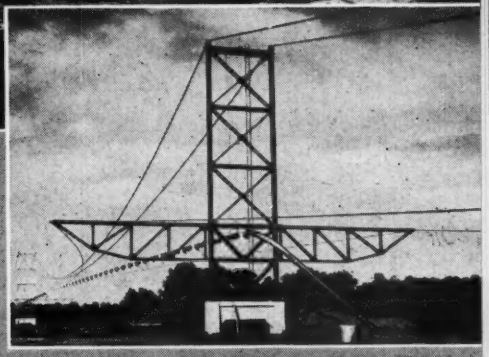
★ EXPERIENCE

★ CAPACITY

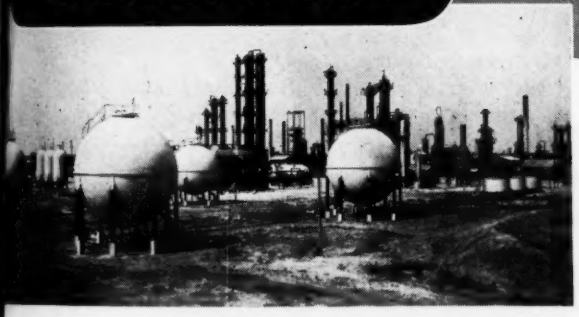
★ RESPONSIBILITY

in the construction of

PIPE LINE BRIDGES



STORAGE TANKS



In the construction of Pipe Line Bridges, Storage Tanks, and Compressor Station Buildings, Pittsburgh-Des Moines Steel Company's service to the natural gas and petroleum industries is completely dependable.

Our field engineers and construction organizations are thoroughly qualified in all types of bridge, building, and tank construction.

Our three modern fabricating plants are strategically located for the very best of service. May we have your inquiries?

COMPRESSOR STATION BUILDINGS

PITTSBURGH-DES MOINES STEEL CO

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	SANTA CLARA, CAL		
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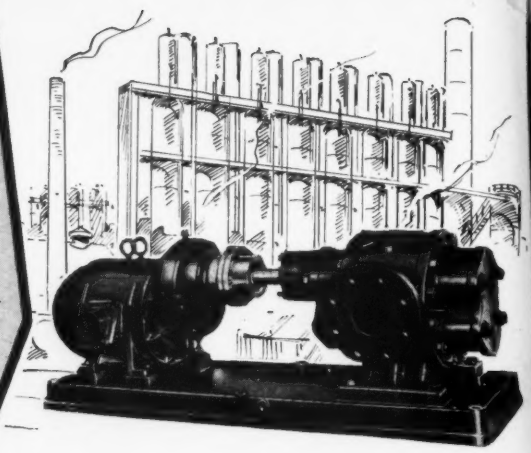
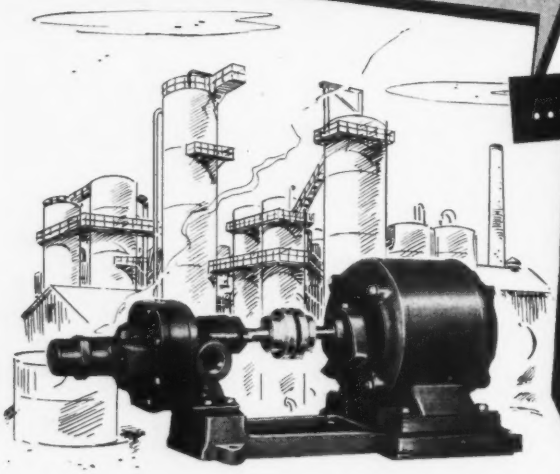
"OLD FAITHFUL"

That's what oil men call the Worthington GR Rotary Pump—a heavy-duty veteran of many years' service in refineries and throughout the petroleum industry. Always ready to do what's expected—and a good bit more—the GR's all-around usefulness is now increased by new inboard bearings and mechanical seals for overhung drives. Fully described in Bulletin W-487-10B.



Worthington Rotary Pump, Type GR.
Capacities to 5,000 gpm. Pressures to 500 psi.
Available with steam or water jackets.

...AND...



Worthington Rotary Pump, Type GA.
Capacities to 51 gpm. Pressures to 100 psi.

"YOUNG FAITHFUL"

Latest and lightest additions to the Worthington Rotary Pump family, the new GA's are similar in general design and construction to the famous GR's—and equally smooth performers in their class. Bulletin W-484-B31 contains a detailed description.

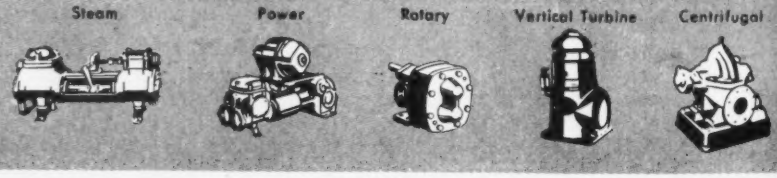
Both the GR and the GA show the advantages of Worthington's long, successful experience in custom-building pumps to refinery requirements. Identical in their outstanding efficiency and economy in many refinery pumping jobs, they join in proving *there's more worth in Worthington.*

Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N. J.

WORTHINGTON

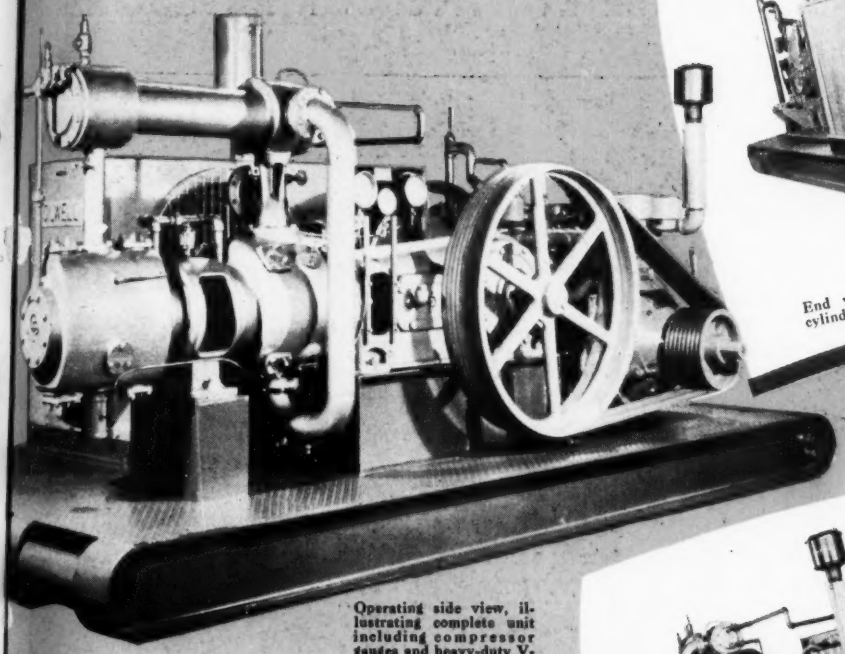
P7-10

THE WORLD'S LARGEST MANUFACTURER OF PUMPS

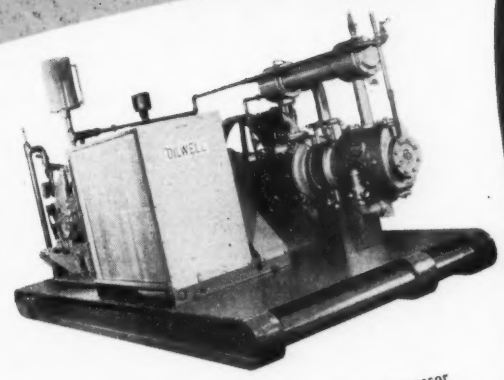


"Oilwell" 2-Stage Gas-Booster Units

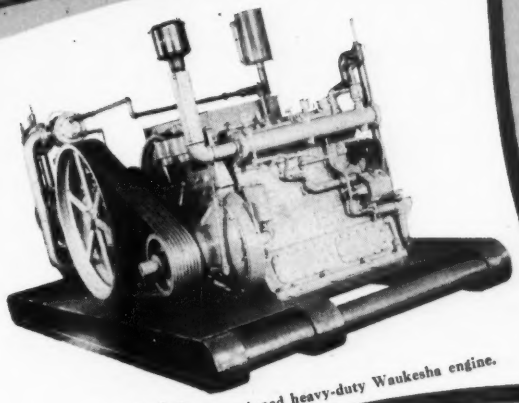
are designed to meet your specific gas problems.



Operating side view, illustrating complete unit including compressor gauges and heavy-duty V-belt drive of the "Oilwell" 2-stage Gas-Booster Unit.



End view illustrating the unit cooler, compressor cylinders with top mounted inter-cooler for dry gas.



Power-end view illustrating specially equipped heavy-duty Waukesha engine.

THE "Oilwell" 11-inch stroke, 2-stage Gas-Booster Unit is rated 75 horsepower at 275 r.p.m. This unit can be used for gas transmission, underground storage, secondary recovery, or recycling operations, and is designed to meet specific gas problems involving low intake pressures and high discharge pressures as well as for handling either wet or dry natural gas.

BOOST GAS PRESSURES ECONOMICALLY

The "Oilwell" Gas-Booster Units are single or multi-stage design, complete with gas engines specially equipped for gas-booster service including a heavy-duty V-belt drive, fan-type cooler for both engine and compressor and necessary pressure gauges.

All units are assembled on a heavy-duty, structural steel skid-base, maximum width 8-feet, which permits convenient transportation of the unit by truck.

"Oilwell" Gas-Booster Units are available in four standard ratings: 25, 50, 75 and 125 horsepower with either single or 2-stage compressors.

Contact your nearest "Oilwell" representative for complete information and any assistance you may desire in analyzing your compressor needs.

OIL WELL SUPPLY COMPANY · USS OILWELL · UNITED STATES STEEL

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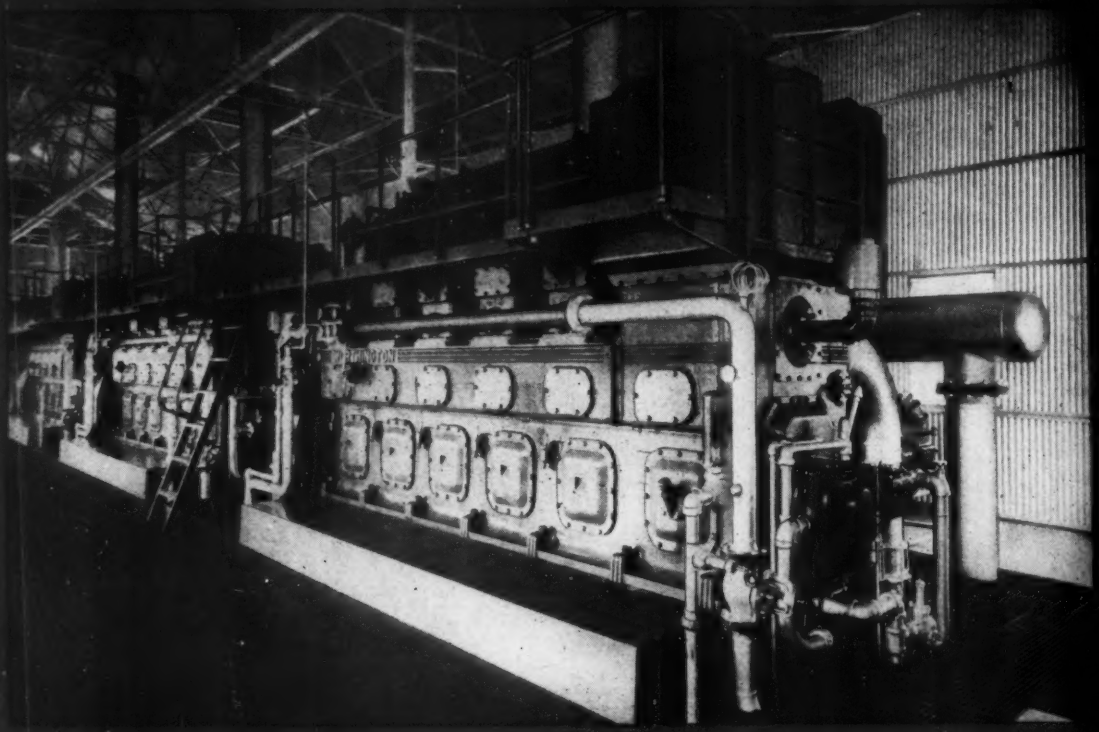
UNITED STATES STEEL

"OILWELL"

Easier to Get At!...

WORTHINGTON ANGLE ENGINE COMPRESSORS



A Battery of Worthington Angle Gas Engine Compressors — Type LTC, 600 hp — in the Halliday, Texas, Plant of Warren Petroleum Company

In these views of Worthington LTC Angle Engine Compressors, note the size and number of covers on both main and compressor frames.

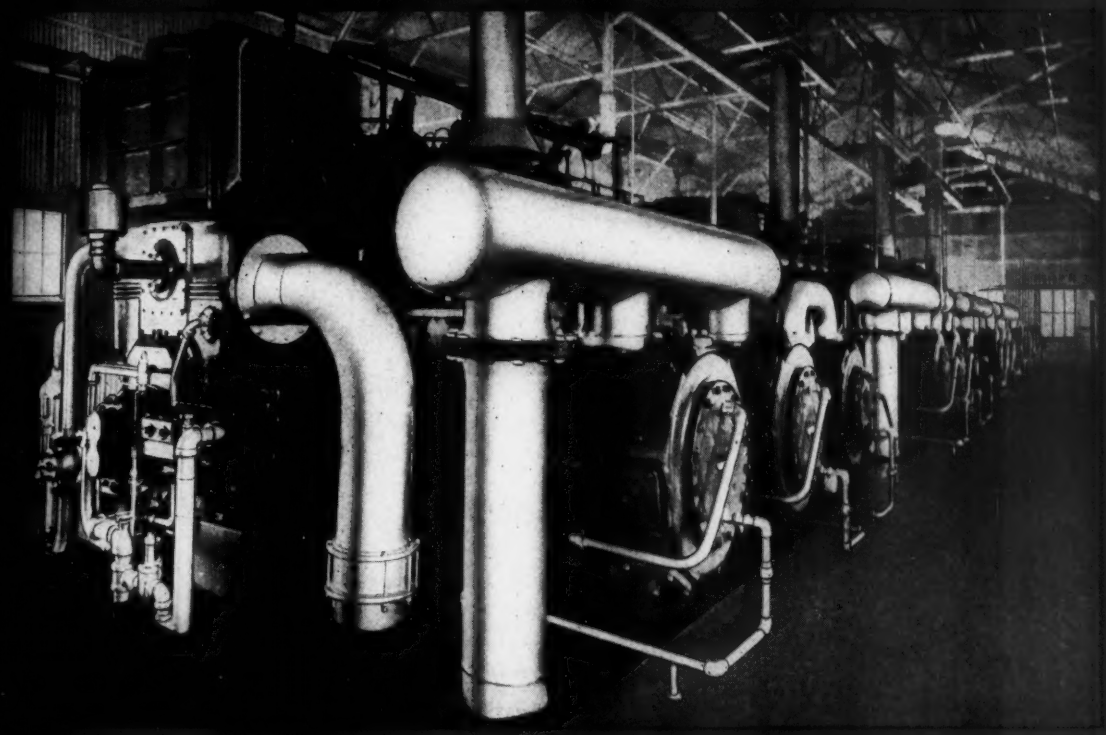
Thanks to this greatly increased accessibility, the work of maintenance crews is so simplified that keeping efficiency at peak is reduced to an easy, effortless routine.

For proof, there's the fact that 99½% running time — day after day, year in and year out — is standard for LTC performance the world over.

And here's another fact: Continuous, record-breaking dependability like this

VERSATILE! Worthington LTC Gas Engine Compressors have been developed to meet many exacting requirements of the oil and gas industries. In pipe line service, for example, their outstanding ability to carry full loads "around the clock" assures economical, uninterrupted gas-transmission.

Easier to Keep Going!



Another View of the Warren Petroleum Company Installation. Worthington Compressors of this Type Range from 400 to 1000 hp, in Four Sizes of Cylinder Combinations

makes big production gains a certainty.

Get the whole LTC story. Write for Bulletin L-690-B1 that shows you why *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

WORTHINGTON

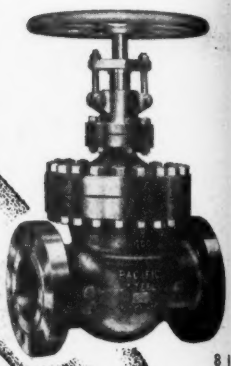
EX8.3

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

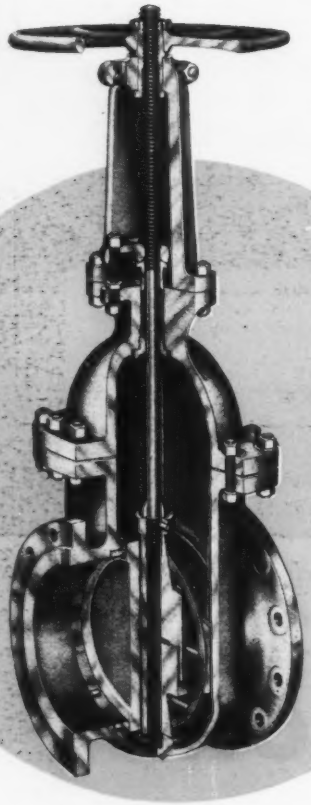
A PIPE LINE FAVORITE

Around the World

DOUBLE DISC GATE VALVES



8 INCH
600 LB. SERIES
N.R.S.



12 INCH
150 LB. SERIES
O.S.&Y.

PACIFIC'S Double Disc Gate Valves are especially designed for rugged pipe line service. Both the Body and the two, self aligning, vertical Disc are designed to compensate for any possible seat distortion caused by pipe line stresses due to pressure variations or temperature changes. These valves are available with outside, screw and yoke or non-rising stem. Send for additional information and prices.

For immediate delivery from Houston warehouse stock, call or write F. M. Tyler & Co., 7211 Avenue B, Houston, Texas. Telephone W 34621

Write for PACIFIC'S New Catalog 48

PACIFIC VALVES, INC.

Formerly PACIFIC VALVE & PUMP COMPANY

2976 Cherry Avenue, Long Beach 7, California · Phone L.B. 485-95

SALES OFFICES: Beaumont, Texas; Houston, Texas; St. Louis, Missouri; Tulsa, Oklahoma; Chicago, Illinois; San Francisco, Calif.; New York City, N. Y.; Cleveland, Ohio

Speed the Work

...CUT COSTS WITH *Genuine* TOLEDO THREADERS

Worker using Toledo 3-Way Threader, capacity ½" to 1" pipe; also on the job, Toledo No. 1A Ratchet 1" to 2" Threader, and Toledo Thread Cutting Oil.

● A good tool saves labor . . . keeps the mechanic satisfied . . . gets the job done faster and better!

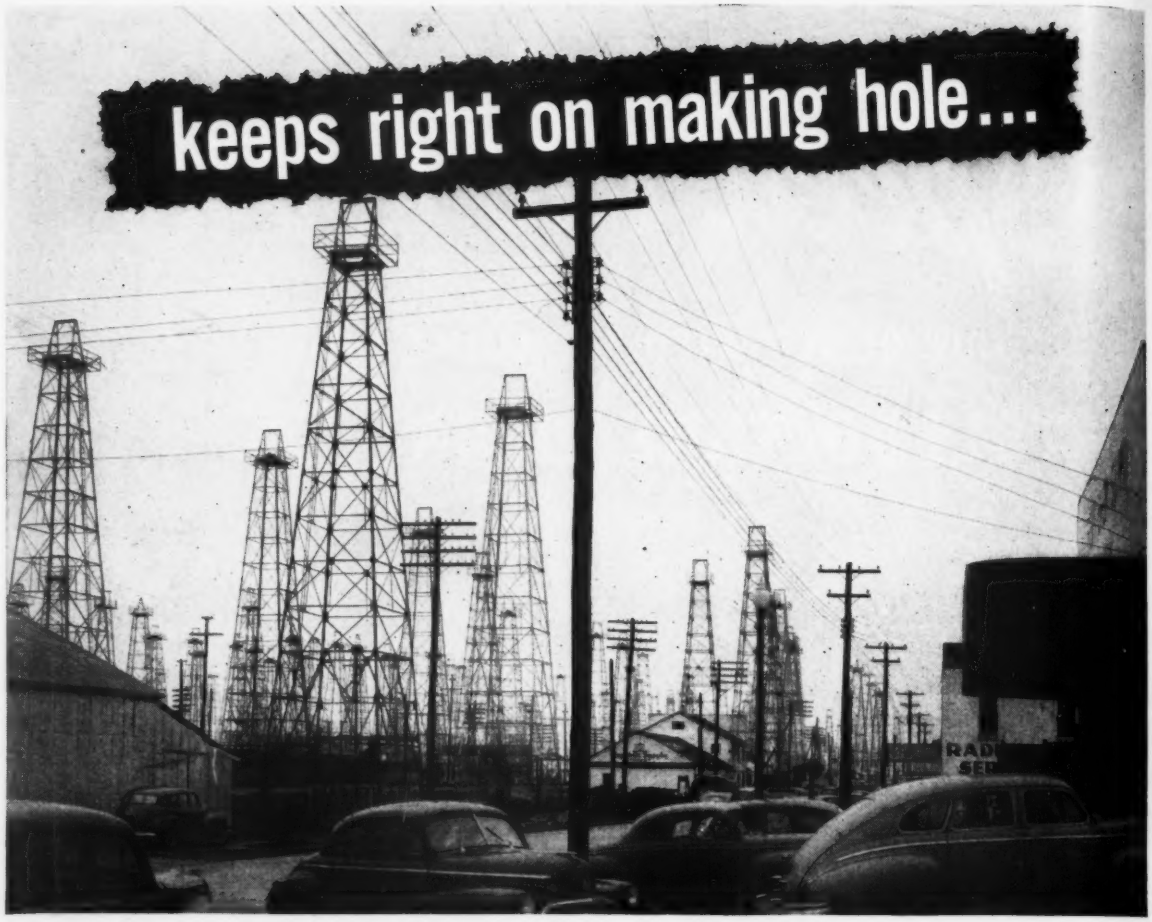
That's why today more than ever it pays to tool up right with TOLEDO Pipe Tools . . . to keep production UP and costs down.

These are the easy-threading tools relied on by thousands of better mechanics for nearly half a century. Engineered to produce clean-cut accurate threads . . . with long-life dependability. Get *genuine* TOLEDO pipe threading and cutting tools and dies for every need . . . including power drives and power pipe machines. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office, No. 2 Rector Street Building.

RELY ON THE LEADER

TOLEDO

FOR PRECISION PIPE TOOLS



WAUKESHA *Diesel Six*

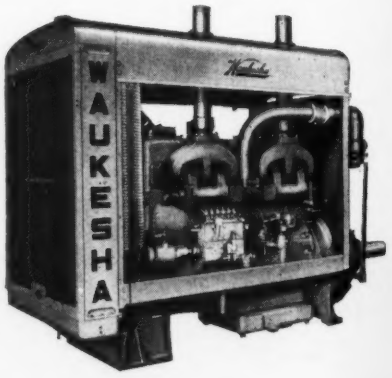
SUPER-DUTY OIL FIELD UNIT ★

... the postwar Diesel for deep drilling. Special Diesel design characteristics are combined with all the wartime-proved materials and features by Waukesha's 40 years' engine building know-how. The result is a super-duty six power plant that keeps your costs down while it keeps right on making hole.

Rugged and ready for heavy duty, yet fast, flexible and smooth—plus the same lively acceleration you have been getting with your gas engines. Easy starting, too ... even in cold weather ... with either the Waukesha gasoline starting engine or electric system.

Clean burning—for high fuel economy. Its patented Diesel combustion chamber, found only in Waukesha Diesels, burns all "high speed diesel fuels" with cetane values of 45 or above.

Operating on the four-cycle principle, its wet cylinder sleeves, precision bearings, simple overhead valve mechanism and other operating and maintenance features of familiar types make this Diesel easy to understand and to service. Send for Bulletin 1418.

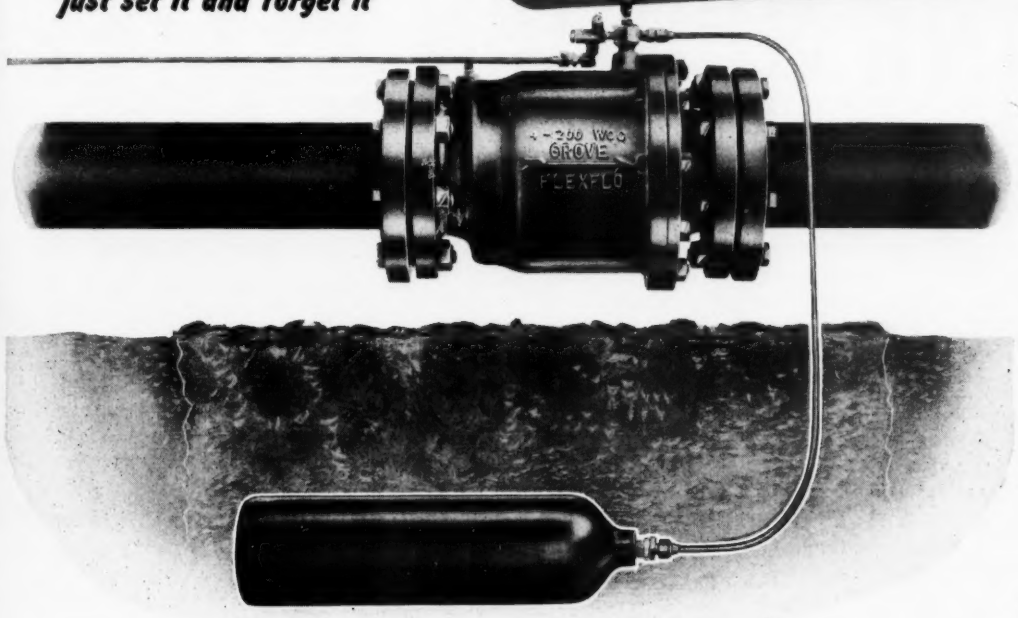


SUPER-DUTY DIESEL SIX
(Model 6-WAKDU)
OIL FIELD POWER UNIT
six cyl. 6¼ in. bore x 6½ in. stroke, 1197 cu. in. displ., 190 hp. max. at 1300 rpm.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS., NEW YORK, TULSA, LOS ANGELES

DO YOU WANT POSITIVE RELIEF from RELIEF VALVE MAINTENANCE

NO SEEP - NO LEAK
just set it and forget it



Employs No Stem or Seats — No Metallic Moving Parts

Grove Flexflo Pressure-loaded *RELIEVER* responds instantly to the slightest variation in line pressure—smoothly opening or closing thousands of times with no sticking, chattering, leaking or failure. Installed in parallel with code-required relief valves, Grove *RELIEVER* does away with troublesome operation and maintenance problems, when set for a slightly lower relief pressure. In other instances, Grove *RELIEVER* is fully dependable and self-sufficient for relief operation. Fully self-contained and self-operating, Grove Flexflo *RELIEVER* is equally well suited as a Back-pressure Regulator operating on constant or intermittent flow. Pressure supply is ground-insulated against temperature changes. Get full details today. Write for Bulletin 888.

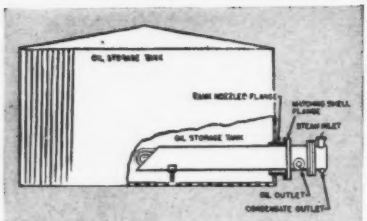
- ★ *CAN'T STICK OPEN OR CLOSED*
- ★ *CAN'T BE WEDGED OPEN*
- ★ *CAN'T SLAM OR CHATTER*
- ★ *POSITIVE BUBBLE-TIGHT SHUT-OFF*
- ★ *SMOOTHLY ROLLS TO OPEN*

DOME

GROVE **FLEXFLO** "PUTS PRESSURE TO WORK"

PRESSURE LOADED **RELIEVER**

GROVE REGULATOR COMPANY • 65TH AND HOLLIS STREETS • OAKLAND 8, CALIFORNIA



PARACOIL TANK SUCTION HEATER INSTALLATION

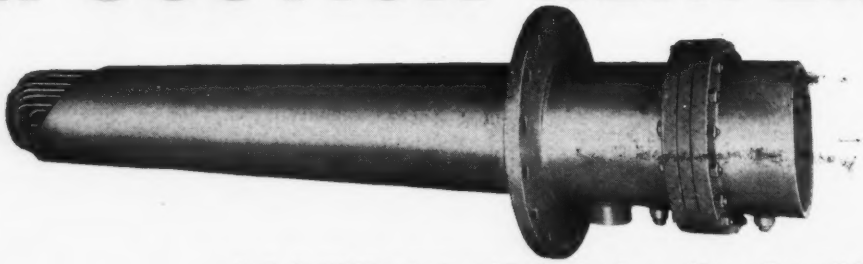
The shell is open at the inside end. The oil moves across the heating tubes as it passes through the shell to the suction connection outside the tank.

??? HAVING TROUBLE PUMPING HEAVY OILS?

??? CONCERNED ABOUT LOSSES RESULTING FROM VOLUME SHRINKAGE AT LOW OIL DELIVERY TEMPERATURES? ...THEN INSTALL

Paracoil

TANK SUCTION HEATERS



In Bulk Oil Terminals and Refineries the world over Paracoil Tank Suction Oil Heaters are licking the problem of economically preheating heavy viscous oils to permit their withdrawal from storage tanks. They are also preheating the lighter grades of fuel oils to their proper delivery temperatures to avoid the costly volume losses incurred when such oils are sold at low temperatures.

WITH PARACOIL TANK SUCTION OIL HEATERS

- **You Heat Only The Oil That Is Being Withdrawn From The Tank.** (Thus radiation losses resulting from heating entire tank contents are eliminated.)
- **Overall Steam Consumption And Heating Costs Are Held To A Minimum.**
- **Heater Tube Bundle Can Be Withdrawn For Inspection And Cleaning.** Breaking of oil suction line not necessary.
- **All Piping Connections And Gaskets Are Outside The Tank.**
- **U-Tube Design Permits Free Expansion And Contraction Of Tube Bundle.** Either high or low pressure steam can be used as the heating medium.

Prompt Shipments!
Our extensive stocks of tubing and pipe enable us to make quick deliveries to meet your immediate requirements.
Write for Descriptive Literature

SPEED UP DELIVERIES AND CUT OIL VOLUME LOSSES WITH PARACOIL TANK SUCTION HEATERS

In addition to the Paracoil Tank Suction Heaters, we also design and fabricate Line Type Discharge Heaters of any capacity. Illustrated is a Paracoil Straight Tube Type Fuel Oil Heater for bulk station service—capacity 2,000 gallons per minute, No. 6 oil, 100°F to 160°F, steam at 15 psig. Weight 12 tons.

DAVIS ENGINEERING CORPORATION

1058 East Grand Street
ELIZABETH 4, NEW JERSEY

30 Rockefeller Plaza
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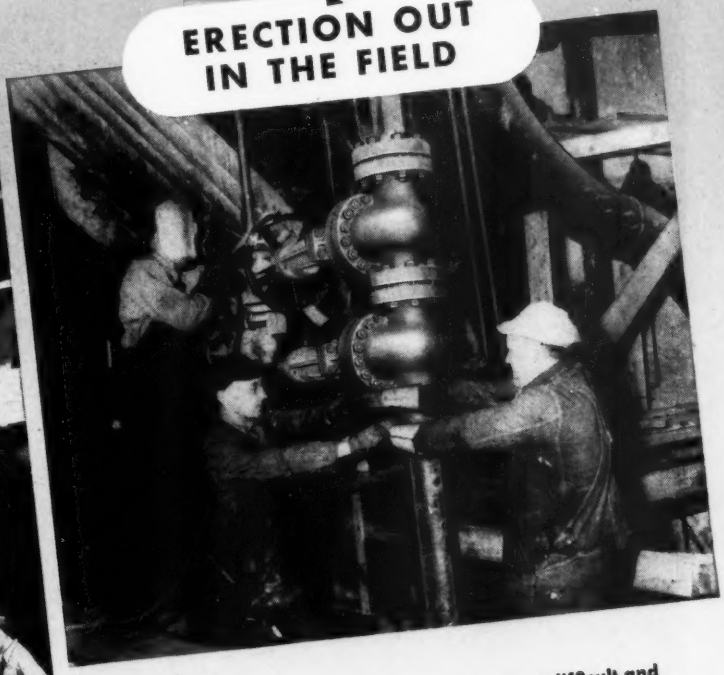
YOU GET BETTER PIPING

because MIDWEST knows piping problems

INSIDE and OUT

PREFABRICATION IN THE SHOP

ERECTION OUT IN THE FIELD



Because Midwest has erected some of the most difficult and exacting piping jobs out in the field, in addition to having prefabricated them in the shops, we have a clear, competent view of piping problems from every angle.

Our Fabricating Department works closely with the Contracting Department . . . continually seeking ways of making their job easier, less costly, and higher in quality. The Contracting Department is always ready to make practical suggestions for improving prefabricated piping subassemblies. It is in constant and intimate touch with piping users in all types of industry. Changes in needs—changes in thinking are quickly relayed to the whole Midwest organization.

The net result to you is better piping whether you want a simple pipe bend . . . a series of complex prefabricated subassemblies . . . or a difficult piping job completely erected.

MIDWEST PIPING SERVICE IS NATION-WIDE

4 PLANTS ARE BETTER THAN 1

PIPING FABRICATORS AND CONTRACTORS

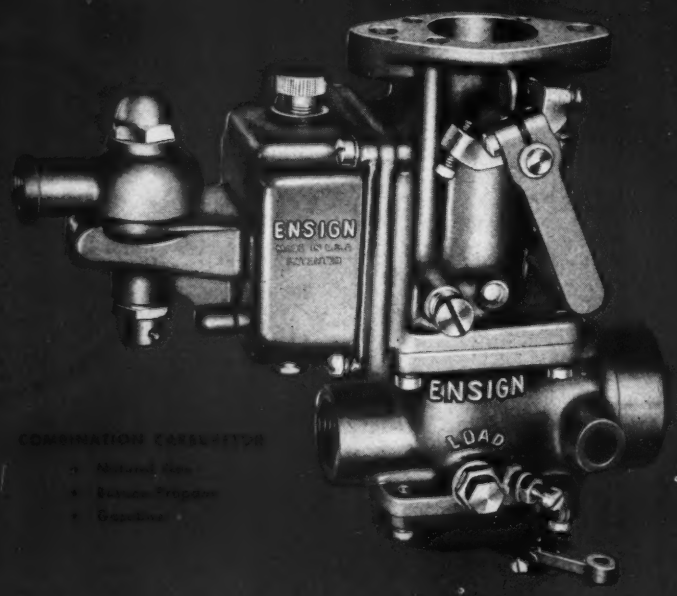
MIDWEST PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and South Boston

Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg.
Tulsa 3—533 Mayo Bldg. • South Boston 27—426 First St.

Ensign



Standard of the Industry

OPERATORS THE WORLD OVER KNOW ENSIGN

Whether you are an operator in the Persian Gulf, South America or in the States, chances are about 100 to 1 that each man on the maintenance crew is long familiar with Ensign Gas Carburetion—its simplicity of operation and excellent performance.

Continued dependable performance of any piece of equipment from gas engines to drilling rigs depends largely upon knowledge of its operating personnel. Operators the world over have used Ensign for years. Little wonder then, that Ensign has become almost an integral part in the design of America's leading gas engines.

Your engines will start easier, run better and longer with less maintenance when carbureted by ENSIGN—Standard of the Industry.

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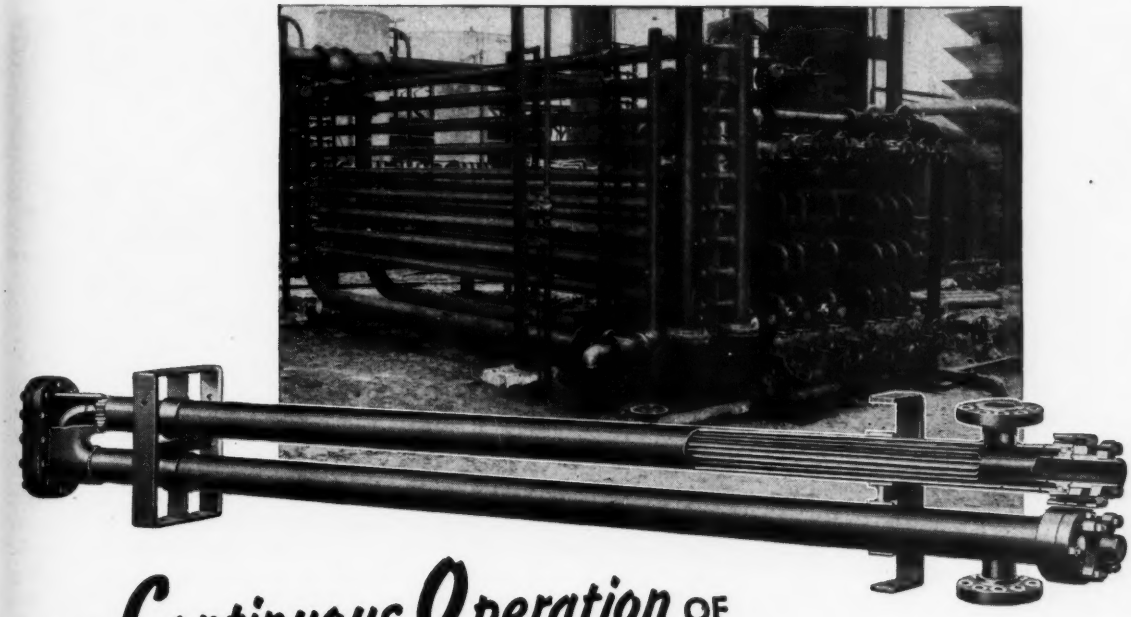
DEALERS AND DISTRIBUTORS IN ALL PRINCIPAL OIL FIELDS



THE *Continuous Operation* OF

BROWN FINTUBE SECTIONAL HAIRPIN HEAT EXCHANGERS

without Shutdowns for Servicing

8 ADVANTAGES

BROWN FINTUBE
Sectional Hairpin
HEAT EXCHANGERS

1. Flanged Shell Seal and Flanged Union Head End Assembly.
2. Extreme Adaptability to Meet the Requirements of Changed Duties.
3. No Obsolescence.
4. Easy Inspection and Maintenance
5. Continuous Operation. No Shut Downs for Servicing.
6. Minimum Investment in Replacement Parts.
7. The Brown Resistance Welded Integrally Bonded Fintube.
8. Easily Removed Rear End Cover Plate.

Write today for Bulletin No. 481. It gives full details

PAYS USERS EXTRA DIVIDENDS

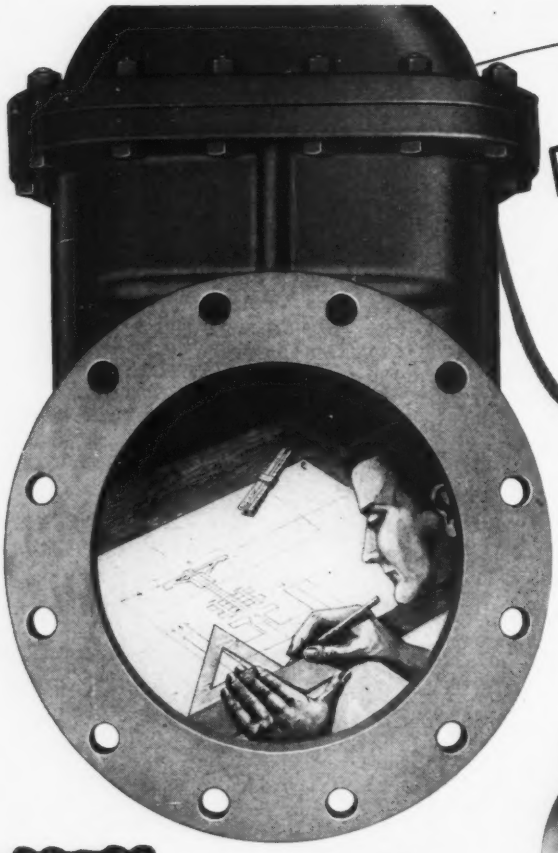
● When they're "on line"—heat exchangers are making money with which to pay wages, bonuses, salaries, dividends. When they're down for servicing,—money is going out—not in.

A bank of Brown Fintube Sectional Hairpin Heat Exchangers can be kept in continuous service—on dirty duty—at high efficiency. The bank doesn't have to come off line for servicing. Users simply manifold an extra parallel stream into the bank. Then they can clean, and make whatever repairs are necessary, to first one stream, then another, while the bank is carrying its full rated load, continuously, at a profit. Simple, isn't it?

Let us help you in adapting Brown Fintube Sectional Hairpin Heat Exchangers—with their many outstanding operating and maintenance advantages—to your next heat transfer requirement. The Brown Fintube Company, Elyria, Ohio. Sales engineers in the principal cities.

BROWN FINTUBE
Sectional Hairpin
HEAT EXCHANGERS

RESISTANCE WELDED INTEGRALLY BONDED FINTUBES AND FINTUBE HEAT TRANSFER PRODUCTS



There's Precision Engineering in every POWELL VALVE

Powell makes valves by the thousands. We have to in order to satisfy the nation-wide demand.

But don't be misled! We know that quality often suffers through so-called "mass production" methods. So every Powell Valve from a standard small bronze globe to the most special design for corrosion resistance is given the most meticulous, individual attention. That's why Powell Valves have such an outstanding reputation for long life and dependable performance in every branch of industry. It pays to install Powell Valves.

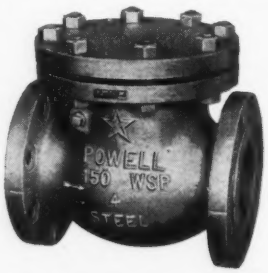


Fig. 1561—Class 150-pound Cast Steel Swing Check Valve with flanged ends and bolted cap. Disc has ample lift to permit full straightway unobstructed flow through the valve body.

Fig. 1460—Iron Body Bronze Mounted "Master Pilot" Gate Valve, with screw ends, rising stem, bolted flanged bonnet and tapered solid wedge.

Fig. 514—150-pound Bronze Gate Valve with screwed ends, screwed-in bonnet, inside screw rising stem and tapered wedge, solid or double.

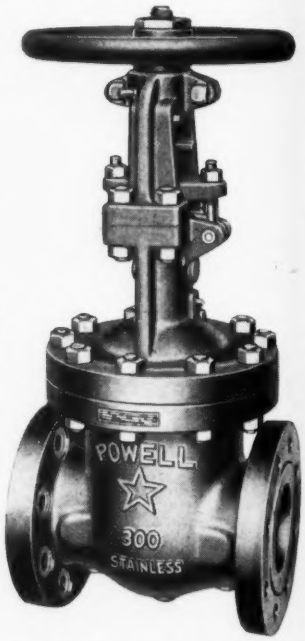


Fig. 3003 S. S.—Class 300-pound Stainless Steel Gate Valve with outside screw rising stem, bolted flanged yoke and tapered solid wedge.

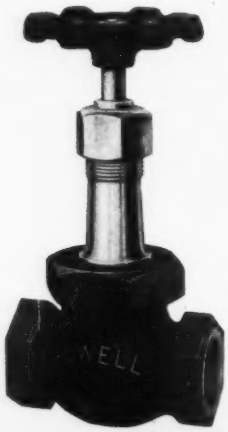


Fig. 190—150-pound Iron Body Bronze Mounted "Irenew" Globe Valve. Has screwed ends, union bonnet and regrindable, renewable, wear-resisting "Powellium" nickel-bronze seat and disc.

The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL VALVES

CLEVELANDS..
the soundest of investments for pipeline trenching

AND SOME OF THE REASONS WHY ARE:

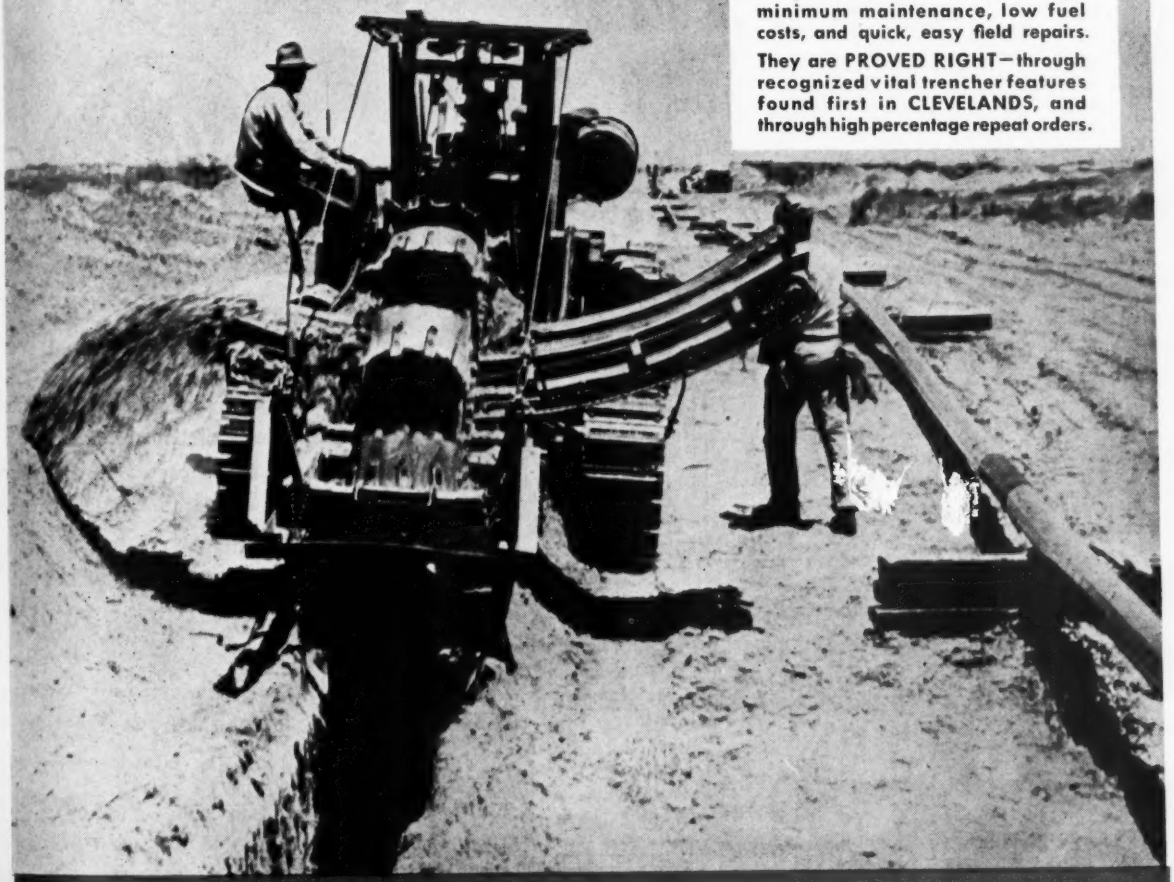
They are **REALLY RUGGED**—through a finely engineered, all-welded construction from tougher materials.

They are **EXCEPTIONALLY FAST**—through more than 30 transmission-controlled speed combinations.

They are **VERY VERSATILE**—through correct, compact full-crawler wheel-type design, simplified steering and low ground pressure.

They are **ECONOMICAL**—through minimum maintenance, low fuel costs, and quick, easy field repairs.

They are **PROVED RIGHT**—through recognized vital trencher features found first in CLEVELANDS, and through high percentage repeat orders.



THE CLEVELAND TRENCHER CO.

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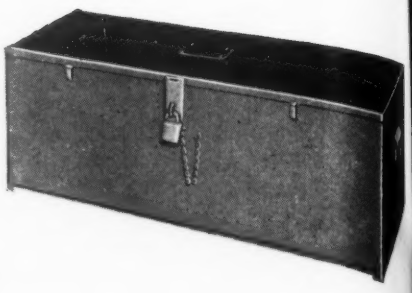
FOR LOWER COST SPARE PARTS...

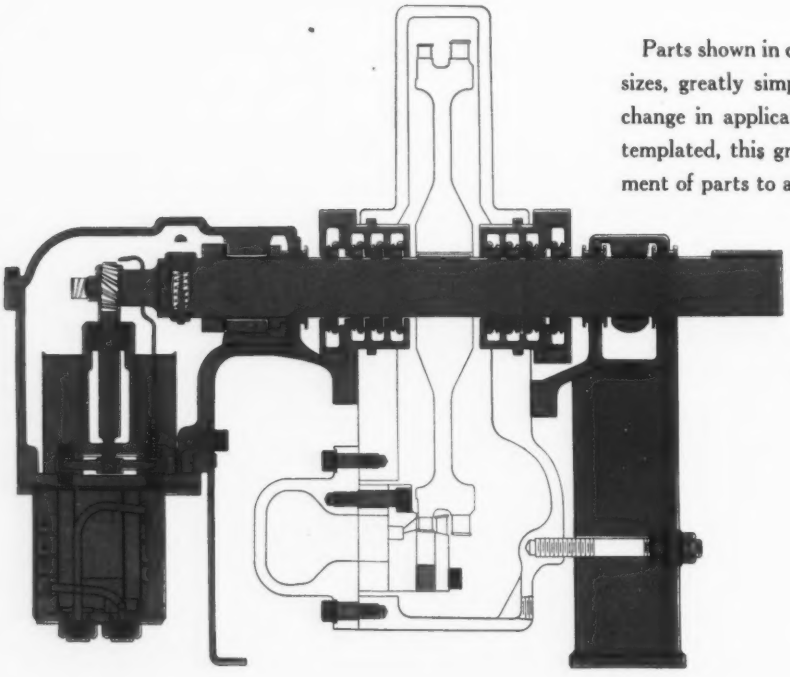


This set of packaged spare parts for the new Type DP turbine line costs you less than 25% of the price of a comparable set of spares for previous G-E small turbines. Greater standardization and improved design make this saving possible.

Best of all is the fact that parts in this standard kit are applicable to *all* Type DP turbines, whether 10 or 1000 hp. This permits you to cut your spare parts inventory drastically, at the same time provide better insurance against shutdowns.

STANDARDIZE

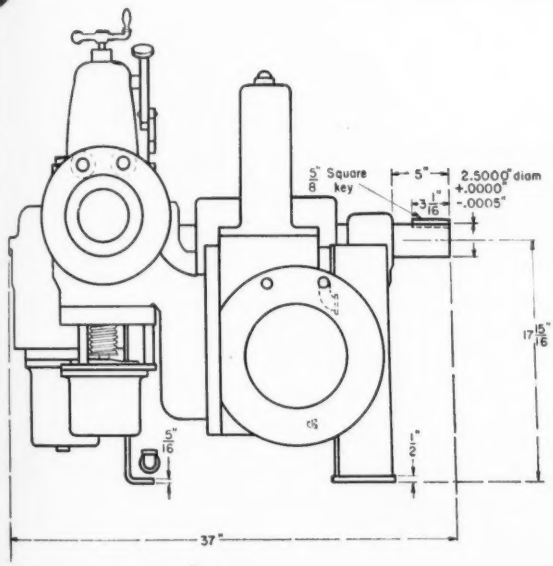
FOR INTERCHANGEABILITY...



Parts shown in color are interchangeable on all frame sizes, greatly simplifying maintenance. Also, where a change in application or rating of a turbine is contemplated, this greater standardization keeps replacement of parts to a minimum.

ON THE NEW STANDARD TURBINES

FOR SIMPLER INSTALLATION...

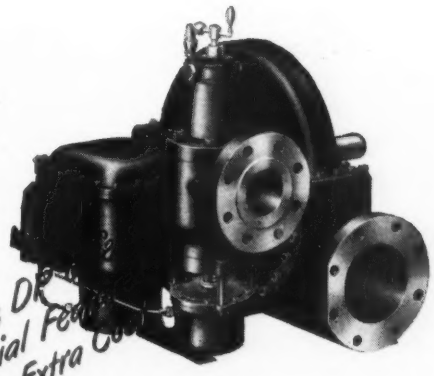


Dimensions shown are common to all frame sizes. For instance, shaft height is the same on all DP units, permitting you to use a standard mounting height on all your turbine drives. Also, all DP shafts are identical, permitting you to use standard couplings.

When it comes to alignment, you'll appreciate the DP's center-line support—now standardized on all frame sizes. Center-line support eliminates misalignment resulting from expansion from normal heating. Once installed, the DP stays in proper alignment—hot or cold.

The greater standardization of the new Type DP line permits us to offer a host of superior design features—all at no extra cost. Price level of the DP line is the same as that of the previous DS line.

For the full story of how these features can mean operating benefits to you, call your G-E representative. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

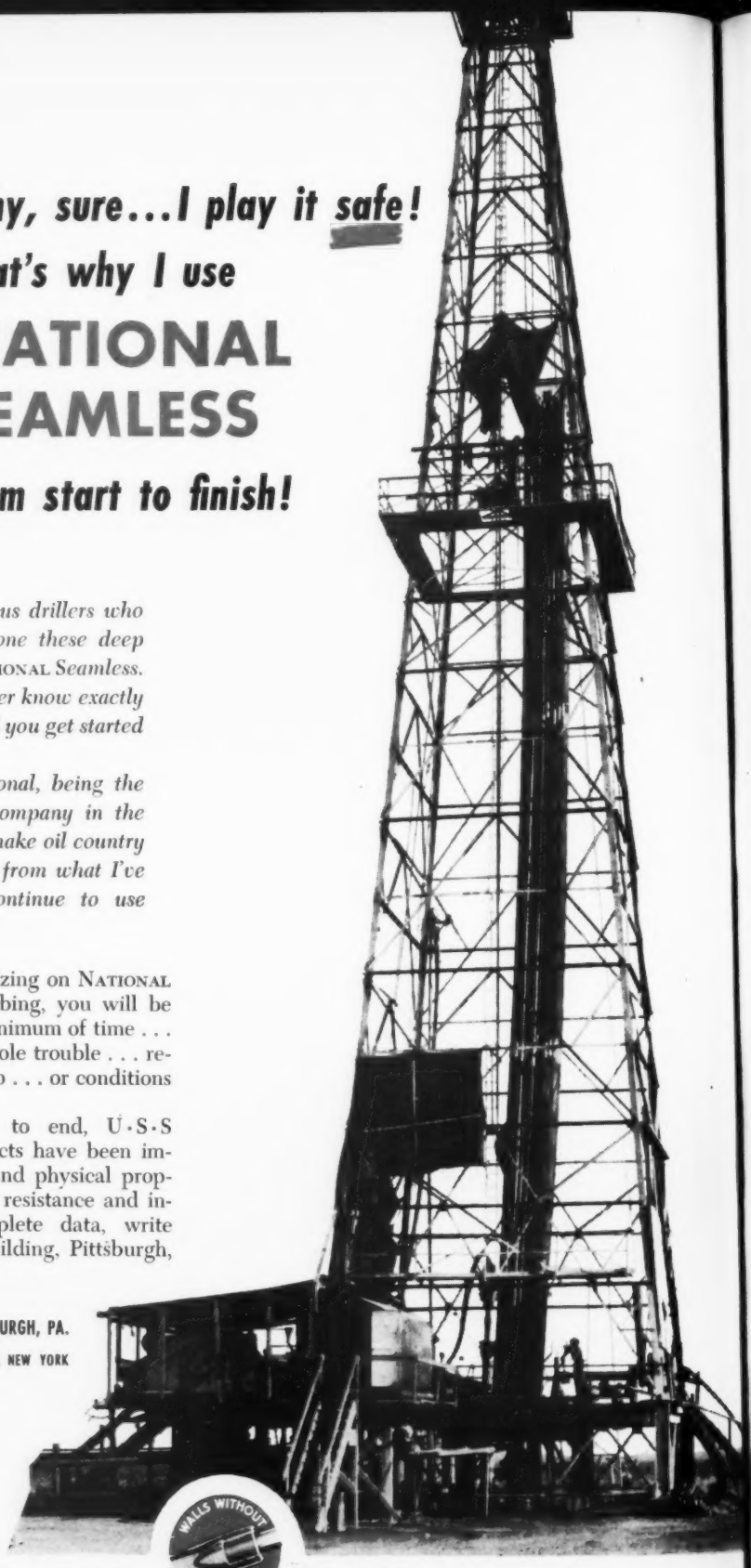


Type DP
Special Fea
at no Extra Co

GENERAL ELECTRIC

252-30

Why, sure...I play it safe!
That's why I use
NATIONAL SEAMLESS
from start to finish!



"Listen, mister, I'm like a lot of us drillers who wouldn't tackle any well—let alone these deep ones—with anything less than NATIONAL *Seamless. Why take a chance when you never know exactly what you're liable to run into until you get started down!*

"You see, we figure that National, being the biggest and most experienced company in the business, ought to know how to make oil country goods if anybody does. Yes, and from what I've seen around other jobs, I'll continue to use NATIONAL *Seamless* all the way!"

You, too, will find that by standardizing on NATIONAL Seamless drill pipe, casing, and tubing, you will be better able to sink your well in a minimum of time . . . and with a minimum of down-the-hole trouble . . . regardless of the depth you have to go . . . or conditions encountered.

Absolutely seamless from end to end, U·S·S NATIONAL Seamless Tubular Products have been improved in both steel composition and physical properties to give them higher collapse resistance and increased joint strength. For complete data, write National Tube Company, Frick Building, Pittsburgh, Pa., for a copy of Bulletin No. 15.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

WALLS WITHOUT WELDS

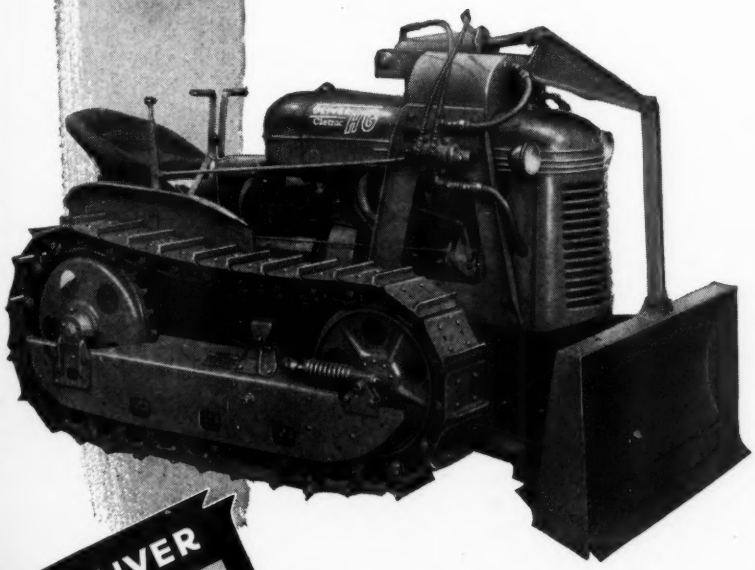
USS

NATIONAL SEAMLESS
drill pipe...casing...tubing

UNITED STATES STEEL

WANTED!

more jobs for this handyman



"THE SIGN OF EXTRA SERVICE"

● We thought we knew all the useful jobs the handy little Oliver "Cletrac" HG tractor and its Imp dozer could do around the rigs. Cutting approach roads . . . digging slush pits . . . building fire walls . . . hauling equipment, it does all those and yet it seems that every day we hear about some new job this "handyman" is doing.

It seems there's no limit to the HG's versatility. Because it's small enough to get into close quarters, it can do a lot of jobs that were formerly done by manual labor. And it is a lot more economical to operate than the big tractor-dozer units so it's a big cost-saver!

If you've used this handyman for some new job, we would like to hear about it. And we might be able to give you some tips on applications that will make your HG an even more useful unit. We've just published a new catalog that gives you all the facts about the HG and its line of accessories and auxiliary equipment. Write for your copy.

Cletrac a product of

The OLIVER Corporation

INDUSTRIAL DIVISION: 19300 EUCLID AVENUE • CLEVELAND 17, OHIO

This man is adding Extra Value to your E-M Heavy-Duty SQUIRREL-CAGE Induction Motor!

Stator coil insulation is built up step-by-step to seal the winding while insulating it. Repeated taping, dipping and baking is shown diagrammatically by the cutaway drawing.

● Expert craftsmanship added to careful design makes coil insulation a dependable component of an E-M Induction Motor.

Built up step-by-step, with multiple layers of high dielectric tape, coils for E-M Induction Motors are sealed as they are insulated. Each layer of tape is impregnated with a tough insulating compound. Each is tightly wrapped, treated with bonding varnish, and then given a controlled baking in an electric oven. Throughout the length of the coil each layer is homogeneous—eliminating weak spots which occur at the joints of sheet insulation and tape insulation.

The completed E-M coil is slightly pliable—a quality it retains through long years of service. This pliability is particularly needed on reciprocating loads such as compressors, where reversing stresses would otherwise break the insulation.

For special applications, such as boiler rooms, the sealed E-M coil is made even more perfectly moisture-resistant by additional processing.

Two other protection points are: *First*—tight coil lashing to a strong end ring, which minimizes movement even under the high stresses of starting. *Second*—a uniform flow of ventilating air around the coils is assured by ingenious design of the rotor and stator core.

LET US TELL YOU more about "Big Motor" engineering. You notice the difference—in rotor construction, in the cool-running wear-resistant bearings and the motor protection of E-M Heavy-Duty Induction Motors, as well as their long life insulation. These are the differences put into E-M Motors by the men who design them and make them.

Write for full data in our publications 189,190.

ELECTRIC MACHINERY MFG. CO.

MINNEAPOLIS 13, MINNESOTA

E-M SPECIALISTS IN **BIG MOTOR** ENGINEERING

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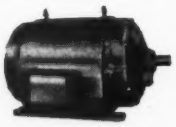
Types of E-M SQUIRREL-CAGE INDUCTION MOTORS

2-pole; drip-proof; ring lubricated bearings.



2-pole; drip-proof; pressure-lubricated bearings.

Four or more poles; drip-proof; sleeve bearings.

Four or more poles; splash-proof; ball bearings.

Sign OF DEPENDABLE PIPE LINE SUPPLIES AND SERVICE

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J&L STEEL

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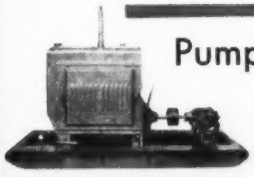
Valves by Darling and Walworth

SMITH Welding Equipment

MIDWEST Welding Fittings



Pumping Units and other Supplies and Equipment

JONES & LAUGHLIN SUPPLY COMPANY

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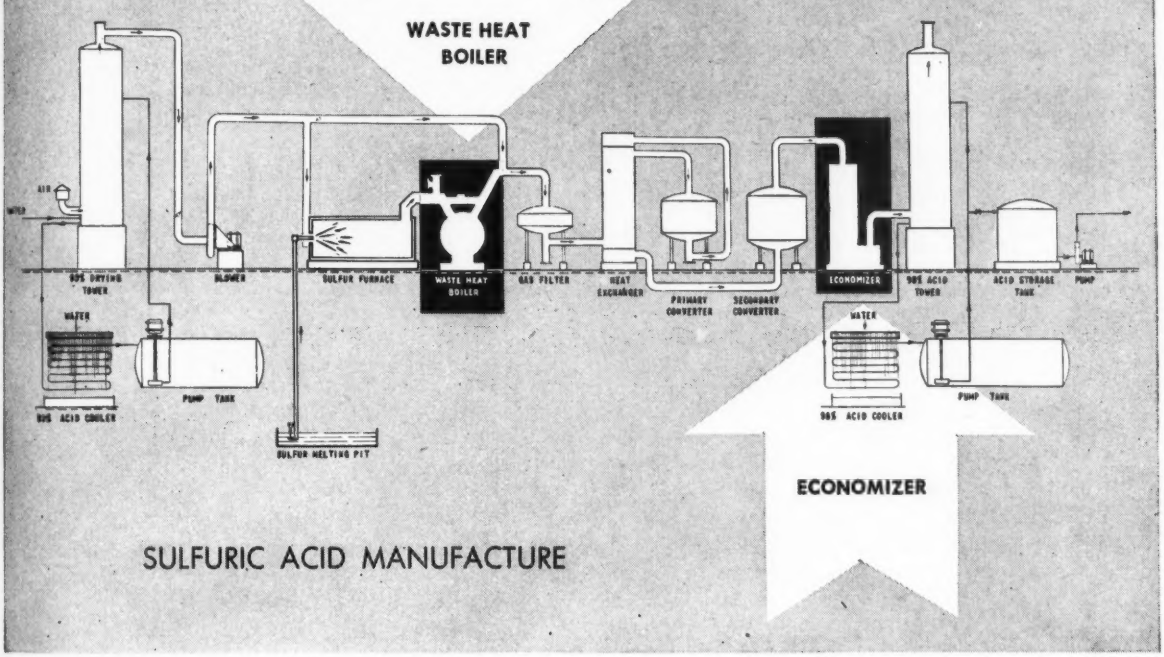
Be *sure* with Pure

Heat Recovery

...an extra saving in

CHEMICO CONTACT ACID PLANTS



Chemico pioneered in the recovery of heat resulting from the combustion of sulfur and from the conversion of SO_2 to SO_3 in contact acid plants. Converting this heat to high pressure steam in waste heat boilers and economizers makes these benefits available:

- ***Economy of operation. Recovered heat premelts the sulfur . . . steam replaces electric power for driving machinery, and heats the buildings in cold weather.***
- ***Combustion gases are cooled to suitable temperatures for conversion.***
- ***The need for a separate supply of steam is eliminated.***

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CABLES: CHEMICONST, NEW YORK

Chemico Plants are profitable investments

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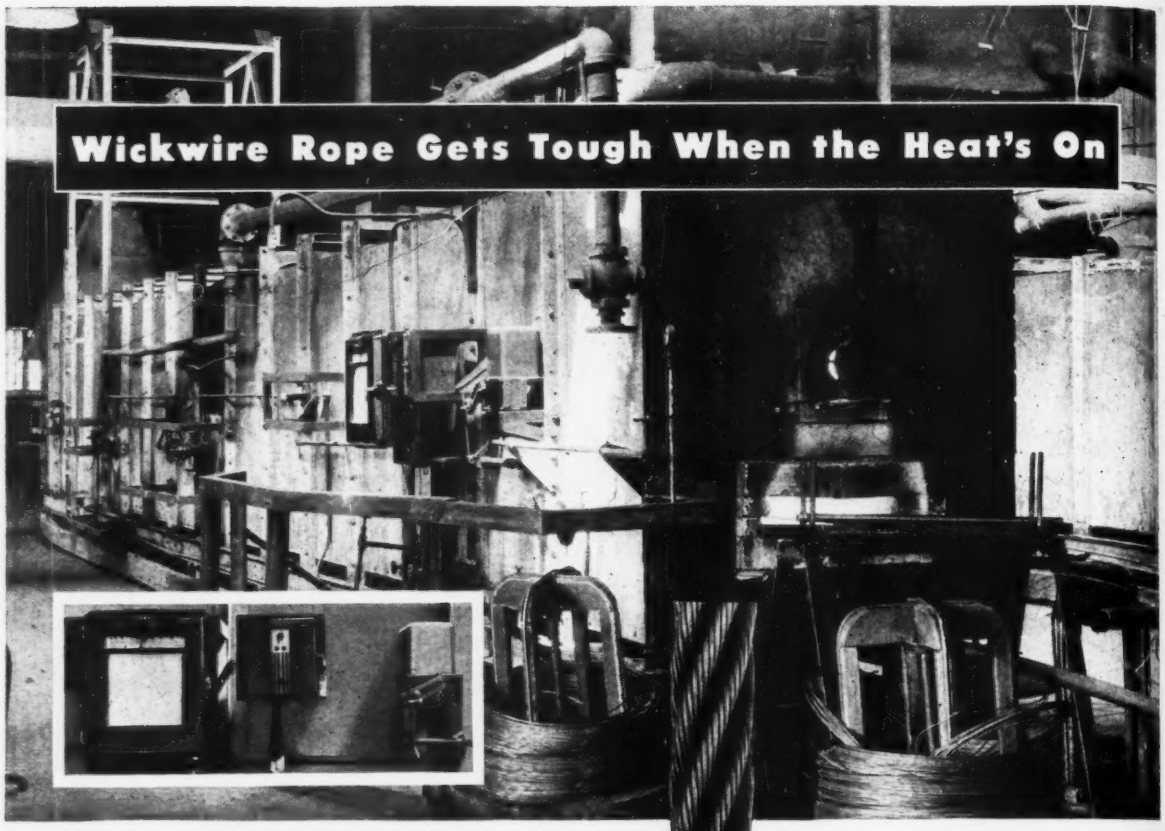

Wickwire Rope Gets Tough When the Heat's On

Traveling through a fiery patenting furnace changes the microstructure of high carbon steel—removes the effect of cold drawing, permits further processing and makes rope wire exceedingly strong and tough.

Temperature and rate of cooling have an important bearing on the size of grains developed in patenting, and grain size determines to a large degree, the physical properties of the wire. That's why the patenting furnaces at Wickwire's newly enlarged Rope Mill have controls so accurate that, even when operating at 1700°F., they anticipate a 5° drop or rise in temperature and automatically regulate the burners.

Accurate patenting temperature is one of many quality controls used in making Wickwire Rope. Because it contributes to rope strength and toughness, it is as important to you as the service of Wickwire distributors and rope engineers who are always ready to help solve your wire rope problems and to supply the right rope for your needs.

For the utmost in performance, safety and long life, specify Wickwire Rope. It is available in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed.

THIS 82-PAGE BOOK ON WIRE ROPE IS FREE —WRITE FOR YOUR COPY TODAY!

Thousands of wire rope users have found that the information packed in the pages of "Know Your Ropes" has made their work easier. It's full of suggestions on proper selection, application and usage of wire rope. It's easy-to-read and profusely illustrated. For your free copy, write: Wire Rope Sales Office, Wickwire Spencer Steel, Palmer, Massachusetts.

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a pictorial record of standard and special built HEAT TRANSFER EQUIPMENT

by Vogt

You are invited to send for this record of ingenuity in heat exchanger design and construction.

Shown, among examples of the many types we build, are units for diversified applications, high pressures, and special operating conditions as well as conventional types for ordinary exchanger services in petroleum refineries, chemical plants, process industries, power plants, etc.

Thousands of installations in successful operation attest to Vogt's ability to give effective help in the solution of heat transfer problems peculiar to a wide variety of operating conditions.

Write for a copy of Bulletin HE-5, on your letterhead.

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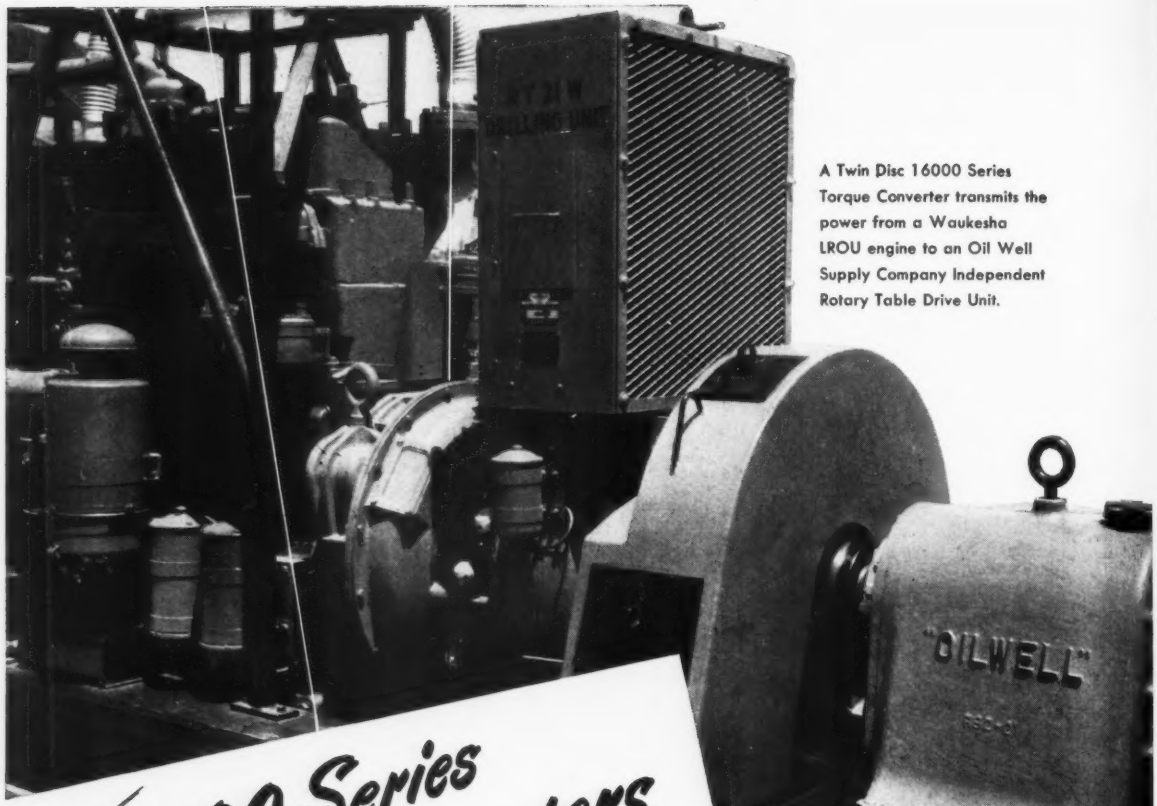
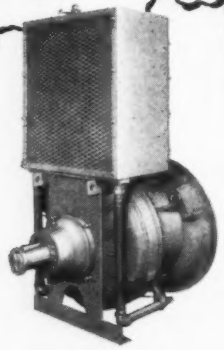


A Twin Disc 16000 Series Torque Converter transmits the power from a Waukesha LROU engine to an Oil Well Supply Company Independent Rotary Table Drive Unit.

16000 Series Torque Converters

. . . for the 250—600 hp Range

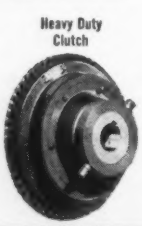


Twin Disc 16000 Series Torque Converter

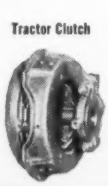
Deep-hole drilling requires more power, and better power transmission equipment. That's why Twin Disc designed its 16000 Series Hydraulic Torque Converter—to meet the requirements of rigs using one or more engines in the 250 to 600 hp class.

Like all Twin Disc Hydraulic Torque Converters, Series 16000 automatically and instantaneously selects the proper torque ratio for the load and the engine power . . . permits uninterrupted acceleration to a maximum speed and an efficient handling of the load . . . cushions all shock loads and torsional vibrations . . . leaves no gear shifting or guesswork to the operator.

The complete line of Twin Disc Hydraulic Torque Converters (Lysholm-Smith type) include three series; 10000, 11500, and 16000 . . . applicable to engines with horsepower ratings of from 30 to 600 hp. For complete information, write the Hydraulic Division for Bulletin 135-C or Bulletin D-430 which refers specifically to the 16000 Series Converters. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Ill.)

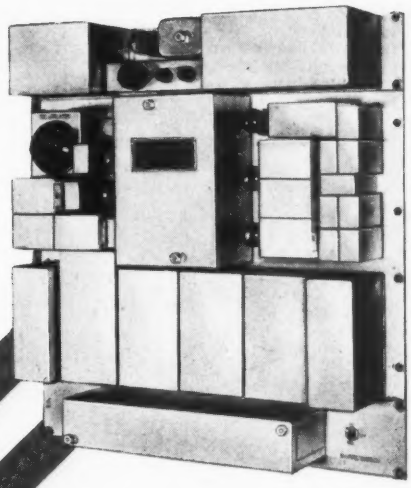


TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

KELLOGG CARRIER gives you MORE db PER DOLLAR!



KELLOGG 5A CARRIER
gives you 30db of operation at a nominal cost per db

"X" CARRIER
provides only 16db of operation at an INCREASE IN COST of approximately 60% per db

"Y" CARRIER
gives only 12db of operation at an INCREASE IN COST of over 100% per db

GIVES LONG-HAUL PERFORMANCE AT SHORT-HAUL COST!

The Kellogg No. 5A carrier provides a 6db talking circuit over a circuit 30 db long (measured at 11 KC). Thus, with the Kellogg 5A carrier, operation is possible through substantial lengths of high loss cable such as 22 ga. exchange cable and without the use of impedance matching devices to overcome reflection losses caused by junctions of open wire and cable.

SAVES CONSTRUCTION COSTS

The single-channel No. 5A Kellogg Carrier System permits transmission of two conversations simultaneously over a two-wire circuit. Handles double traffic—*without* the expense of added lines, extra maintenance or heavier poles. Improves transmission quality by eliminating powerline hum.

EASY TO INSTALL, MAINTAIN — AND IT'S *DEPENDABLE!*

Mounts on any 19" rack, needs no oscillator synchronization, no frequency adjustments in the field. All adjustments except voice and carrier output-level pre-set at factory. Requires almost no maintenance except occasional replacement of a vacuum tube.

ADAPTS FOR EVERY REQUIREMENT

Designed on a flexible "unit" basis, for easy adaptation to various applications. Adding a second channel requires only a few external connections. (Models available too, to meet every service need.)

KELLOGG CARRIER

Send Coupon for Complete Information TODAY!

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6650 South Cicero Avenue • Chicago 38, Ill.

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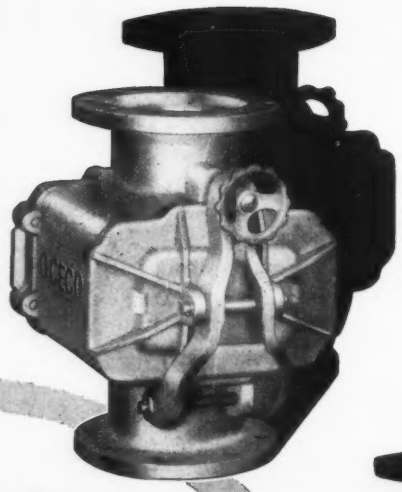
Please send full details on your carrier systems:

NAME:_____

ADDRESS:_____

CITY:_____ STATE:_____

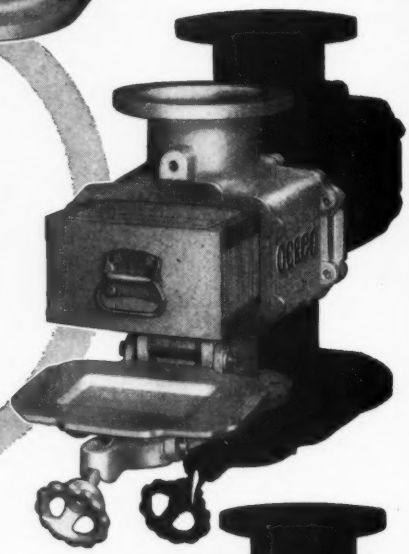
Oceco 2" Flame Arrestor Showing Screw Mounting and Side Hinge.

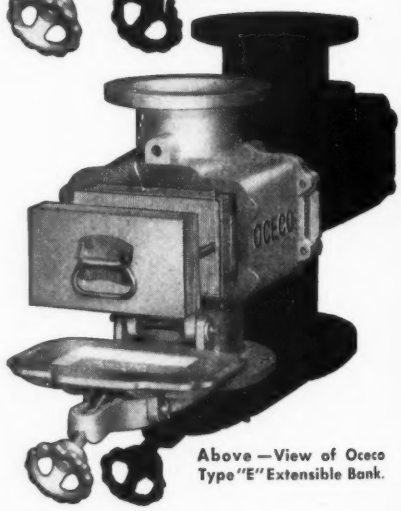


Oceco 6" Flame Arrestor Showing Flange Mounting and Bottom Hinge.

OCECO
FLAME ARRESTORS
for outstanding performance

Below—View of Oceco Type "F" Fixed Bank.





Above—View of Oceco Type "E" Extensible Bank.

● Oceco Flame Arrestors—have won outstanding recognition throughout the entire petroleum industry. They combine the desired flame stoppage and explosion prevention with minimum pressure drop.

Housings and covers are semi-steel castings, with high melting point and consequently provide substantial heat resistance and protection to the flame arrestor "bank", even when subjected to the intense heat of sustained fire.

The "banks" consist of flat and corrugated sheets of high purity, corrosion resisting aluminum arranged alternately to form vertical straight through passages. They are of sufficient depth, top to bottom, to resist "burning through",—and the straight through passages minimize depositing of moisture and clogging;—and simplify inspection.

Furnished in 2" and 3" sizes for screw mounting and 4", 6", 8" and 10" sizes for flange mounting;—with either type "F" fixed banks, or type "E" extensible banks, that permit the plates to be separated for individual cleaning. Send for Bulletin No. 471. It gives full details.

OCECO

Division of THE JOHNSTON & JENNINGS CO.

CLEVELAND 14, OHIO

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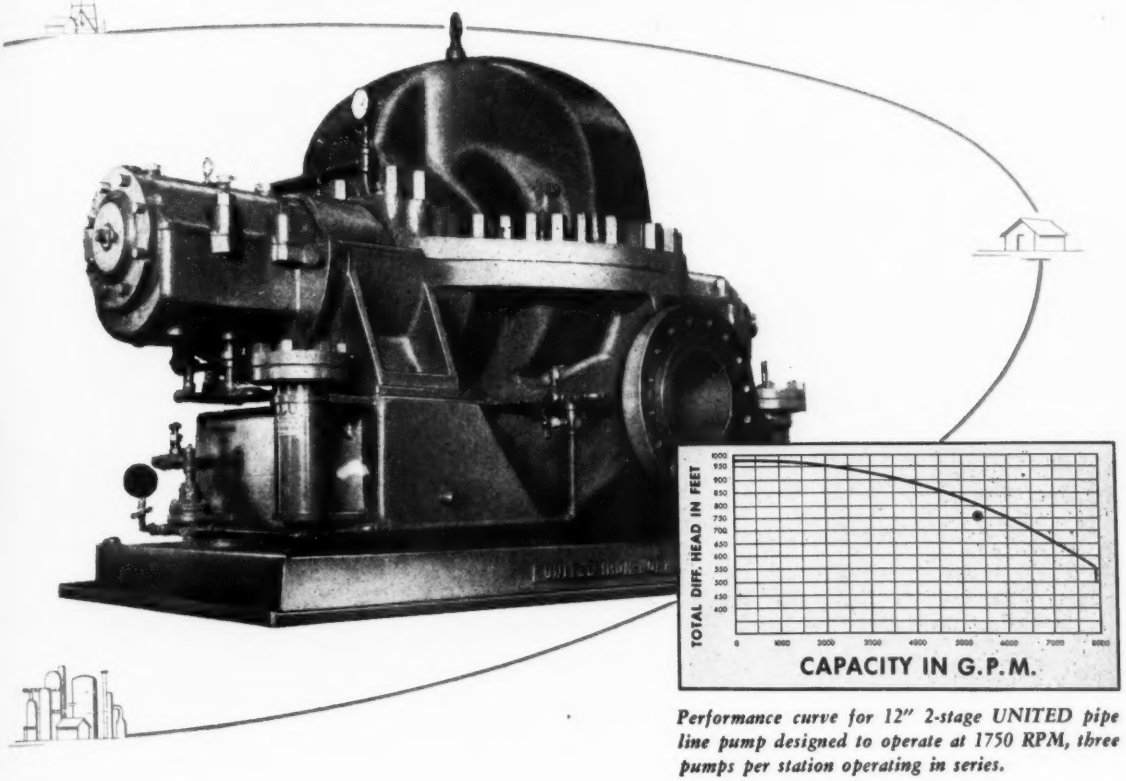
UP TO 225,000 BARRELS OF OIL PER DAY HALF-WAY ACROSS THE NATION



Performance curve for 12" 2-stage UNITED pipe line pump designed to operate at 1750 RPM, three pumps per station operating in series.

That's the job to be done by 33 of these huge UNITED centrifugal pumps. Each is specially engineered to meet the specific requirements of its own particular location along one of the country's great new pipe-line systems. From final tests, they're now rolling on to meet installation schedules. Behind this achievement lies a quarter of a century of specialized engineering service to the petroleum industry, plus practical know-how in modern production methods. That's why every UNITED pump carries the assurance of long, trouble-free service and efficiency. Write today for detailed information on pumps and services to meet your specific pipe-line or refinery requirements.

UNITED CENTRIFUGAL OIL *pumps*

Since 1880

UNITED IRON WORKS • *Main Offices and Plants* • OAKLAND, CALIFORNIA
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for Engineers Interested in Valves and Piping . . . Steam, Water, Oil, Gas, etc

Here's the Book you've been waiting for:

96 Pages
of Illustrated, Diagrammatic and Tabular Matter regarding . .

PHILADELPHIA
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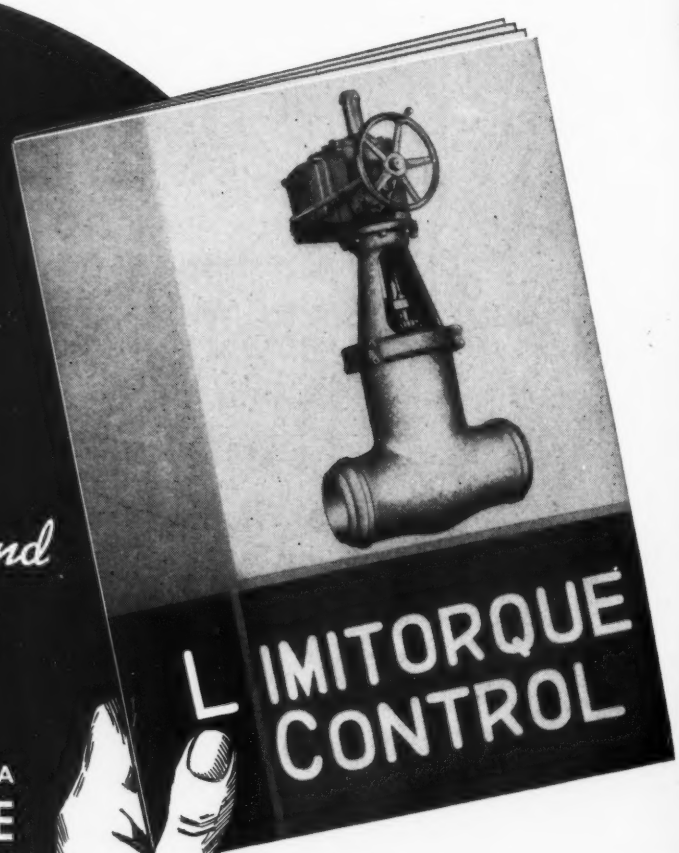
VALVE CONTROLS

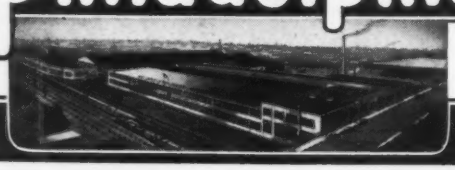


Hundreds upon hundreds of valves on land and sea — for every conceivable use, are being safely, speedily and dependably opened and closed by *LimiTorques* day in and day out.

Yes, this catalog shows different types; how they work; how they are connected; wiring diagrams; control panels; floor stands; position indicators; pictures of *LimiTorques* in action in all types of plants; views of *LimiTorques* applied to most all makes of valves, etc.— indeed, a veritable "treatise" on Motorized Valve Operation.

Please be sure to use your *business letterhead* when writing for this valuable catalog.

Philadelphia Gear Works, INC.



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Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Alloy Steels *Save Weight*

. . . because they can be used in thinner sections—without loss of strength and toughness

● There is no excuse for efficiency lost because working parts or tools are burdened with excess deadweight. Nor is there any reason for unnecessary bulkiness where streamlining is desirable. The high strength-to-weight ratio and wear-resistance of Republic Alloy Steels are proving both of those statements today in all types of oil country equipment and tools.

Because of the ideal combination of high strength, toughness and hardenability in these fine steels, it frequently is possible to reduce cross-sectional areas and bearing surfaces—without any loss in safety factor, service life or ultimate cost.

Republic—world leader in the alloy steel field—is well prepared to discuss the advantages of these steels as applied to *your* individual needs. Write us.

Swivels are but one of the many items of oil country equipment which have been improved through the application of Republic Alloy Steels. Others include drill bits, kellys, slips, blocks, draw works, pumps and tool joints. Ask Republic metallurgists what alloy steels can do for your equipment.

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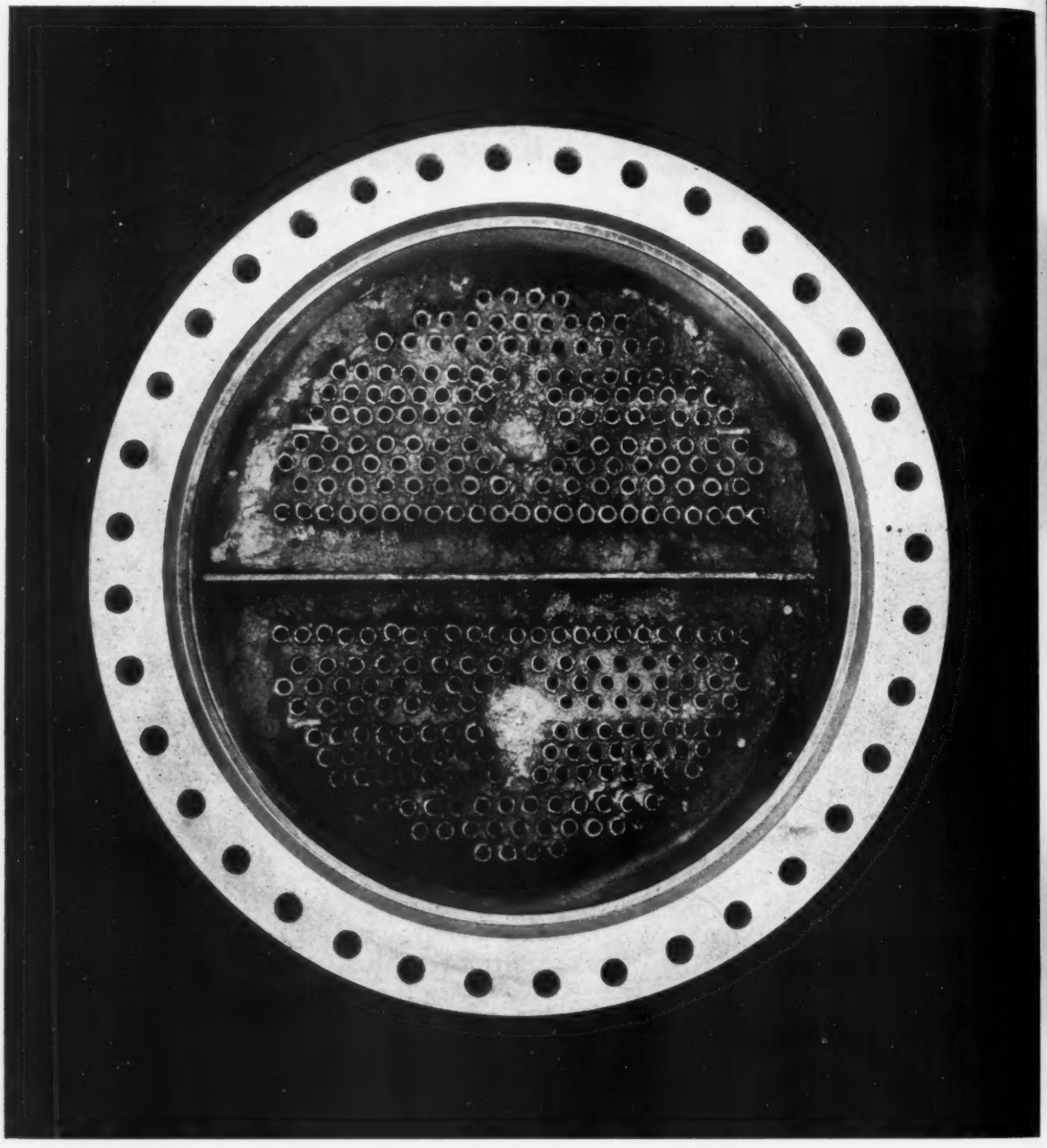
Republic ALLOY STEELS

REPUBLIC STEEL

Other Republic Products include Casing—Tubing—Line Pipe—Upson Studs, Bolts, Nuts and Rivets—Electrunite Boiler Tubes



WHICH TUBES NEED REPLACING?

Improved electronic device spots bad condenser or heat exchanger tubes BEFORE THEY FAIL!

● Put the maintenance of your tubular equipment on a scheduled basis with the improved PROBOLOG.

Save Time and Trouble by regular check-ups that will be ahead of sudden tube failures that cause emergency shutdowns. No more good tubes removed through error... no more bad tubes left in place.

Spot Defects in non-magnetic metallic tubes such as: eroded and corroded pits; cracks; strained and dezincification areas; abnormal changes in physical dimensions.

• • •

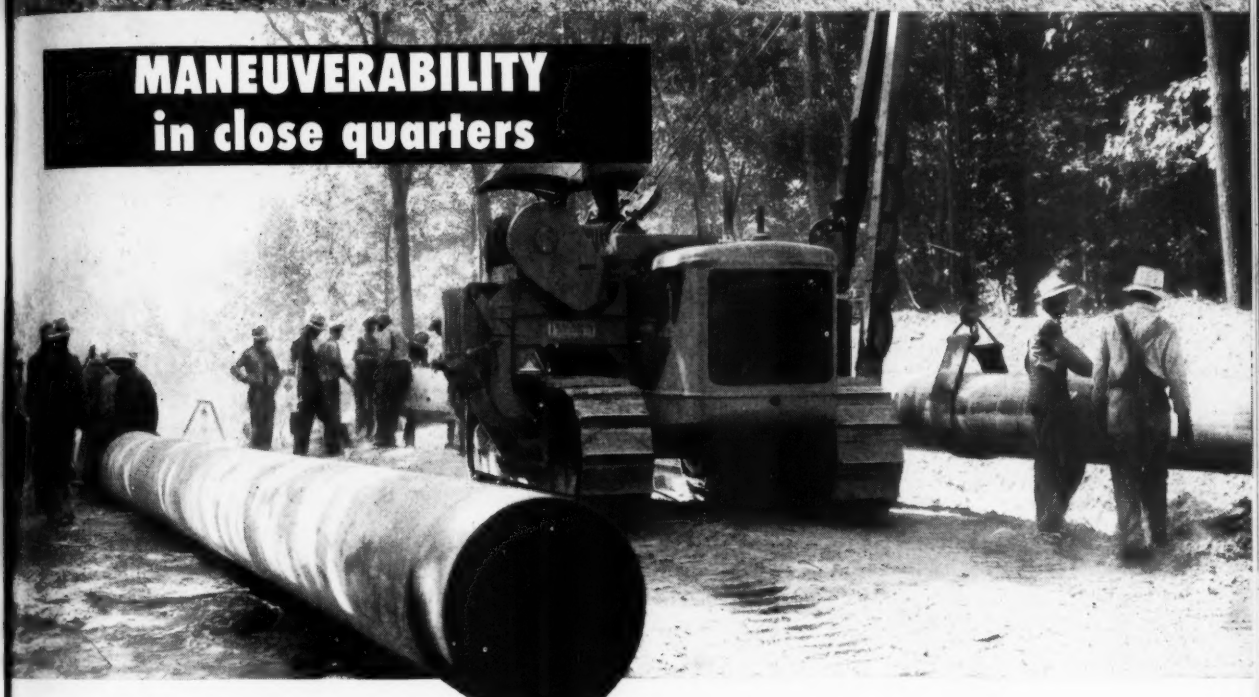
See a demonstration of this compact, lightweight equipment to appreciate its cost-saving possibilities. For more particular information about the PROBOLOG, communicate with the Shell Development Company, Incorporated, 50 West 50th Street, New York 20, New York.

SHELL

SHELL DEVELOPMENT COMPANY
INCORPORATED

Trackson Pipelayers give you BOTH

SPEED in the open



MANEUVERABILITY in close quarters

TRACKSON PIPELAYERS earn money for you on two counts: When you're in the clear — it's speed you want to cover more miles. When in close quarters — you need agility and maneuverability to get the job done.

TRACKSON PIPELAYERS are on the job every minute from start to finish — lifting, carrying, lowering and bending pipe — handling small, light sections or heavyweight, large-diameter pipe. Storage yards, material handling and draw-bar work are other jobs where TRACKSON PIPELAYERS cut time and costs.

See your TRACKSON-"Caterpillar" dealer for more information on how to lay pipe faster and cheaper with tools that have been specially designed and built to do the work; or write direct to the TRACKSON COMPANY, OG-98, Milwaukee, Wisconsin.

TRACKSON

TRACTOR EQUIPMENT

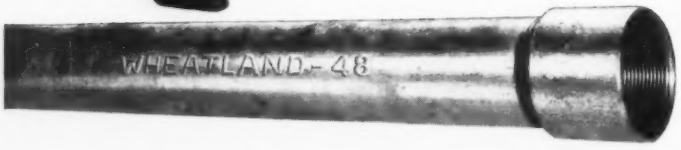
The Story of a Champion

"THE BABE RUTH STORY" could only happen in a country such as ours.

The Great Bambino means more than Home Runs—more than Baseball itself. This thrilling movie is the story of a man beloved by people of all ages—a symbol of sportsmanship and fair play that will stand as a timeless mark!

The Wheatland Tube Company is pleased to call this great event to your attention—because we like to feel at all times that in our relationship with Wheatland customers there exists a code of sportsmanship and fair play that is more than buying... more than selling...

Babe Ruth
baseball's most spectacular star, is brilliantly portrayed by
WILLIAM BENDIX in
Roy Del Ruth's production
"The BABE RUTH *Story"*
an ALLIED ARTISTS *picture*



-pipe with the yearmark!

WHEATLAND TUBE COMPANY
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RUSH SHIPMENT IS STANDARD PRACTICE IN THE GASO PARTS DEPARTMENT

It pays to look ahead when buying pumps. The sturdiest specimens—yes, even Gaso Pumps—may some day be forced down by wear of or damage to a part. At Gaso every parts order is a call for emergency action. Precision-machined parts are selected from carefully maintained stocks, checked against complete records and rushed by quickest means to destination. Replacement is speeded, shutdown time reduced. Another reason why you get more for your money when you specify Gaso Pumps.

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GASO PUMPS
for every oil industry need

it's easier to

"GET THE JOB DONE"

when you make OUR warehouse YOUR warehouse

If it's your responsibility to "get the job done," we can help you do it quicker and easier.

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- We can help you avoid expensive shut-down time by getting the right equipment to the right place at the right time.

And we can help you speed up the job by suggesting proved new equipment. We can also make helpful suggestions on how successful operators use the equipment in conditions similar to yours.

- Our complete stocks enable us to fill your every need promptly — we are even prepared to make immediate delivery on many scarce items.

For service you can always depend on
Call your
NORVELL-WILDER MAN

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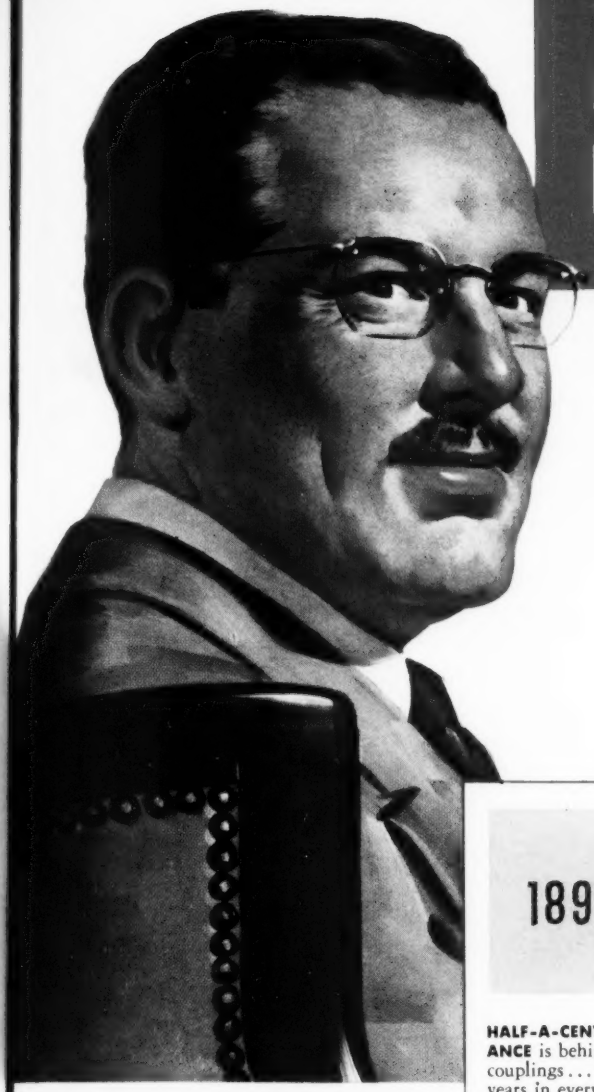
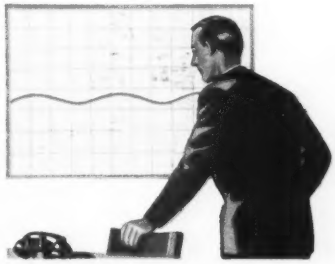
SUPPLY COMPANY

AXELSON FIRST CHOICE

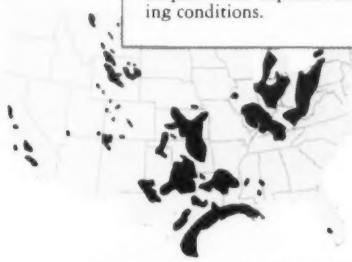


OILFIELD PRODUCTION EXECUTIVES AGREE AXELSON Sucker Rods and Couplings set the quality and dependability standards for the entire industry. AXELSON'S specialization in sucker rod manufacture with a complete factory devoted solely to their production, assures consistently high quality and reliability.

HALF-A-CENTURY OF PROVED PERFORMANCE is behind AXELSON sucker rods and couplings . . . continuous service through the years in every domestic and foreign field . . . unquestioned dependability under all pumping conditions.



LESS DOWN-TIME PRODUCTION LOSSES from rod string failures . . . Finer steels of special alloys . . . advanced design . . . precision machining . . . skillful heat-treating and normalizing, combined, help maintain more profitable production.



WAREHOUSE STOCKS CLOSE TO MOST LEASES mean prompt delivery of rush orders . . . minimum down-time waiting for rods . . . lower production losses . . . greater rod crew efficiency.

FEWER EXPENSIVE PULLING AND FISHING JOBS when AXELSON rods link the prime mover to the pump . . . rods and couplings are engineered for greater strength . . . resist fatigue and corrosion better . . . make up easier . . . last longer in all wells.

FREE TO PETROLEUM PRODUCTION MEN: *"Not How Much . . . But How Well," a 56-page book tells the story of* AXELSON'S *sucker rods and couplings. Write today for your copy.*

AXELSON *Sucker Rods*

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

PROVED DEPENDABILITY FOR OVER HALF A CENTURY

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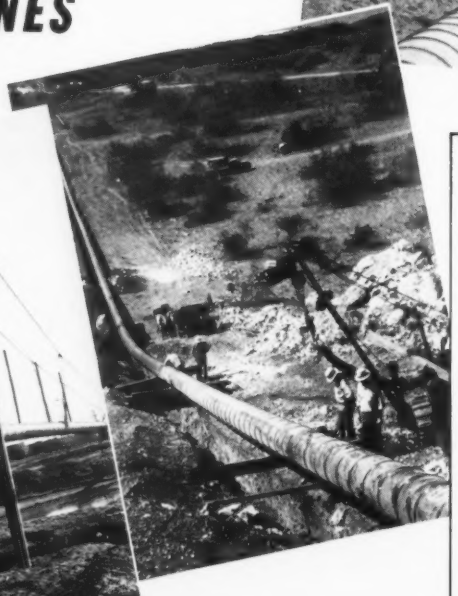
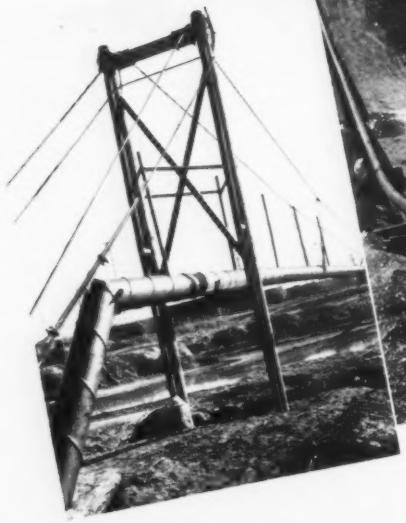
IT'S NAYLOR—

the Light-weight LINE PIPE for PIPE LINES





NAYLOR APPLICATIONS IN OIL FIELD SERVICE

- Gas and oil lines
- Gas and oil gathering
- Water lines
- Sludge lines
- Vacuum lines
- Syphon pipe
- Tank gauge pipe
- Tank swing pipe
- Threaded surface casing

Sizes from 4 to 30 inches in diameter. All types of fittings, connections and fabrication.

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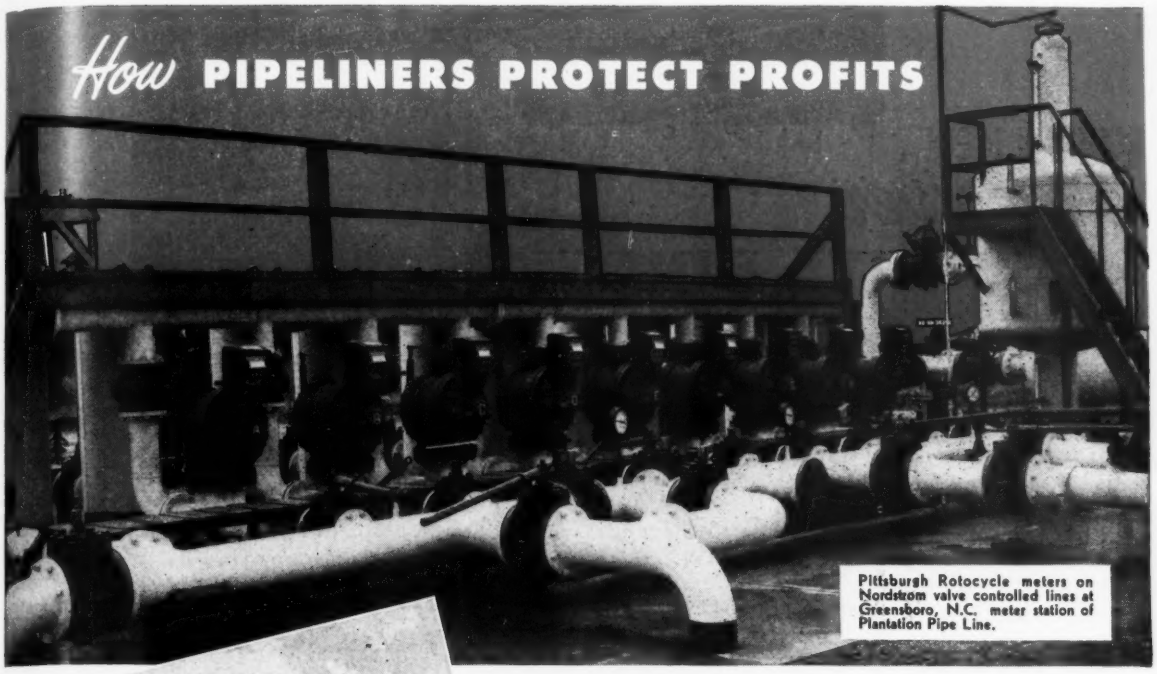
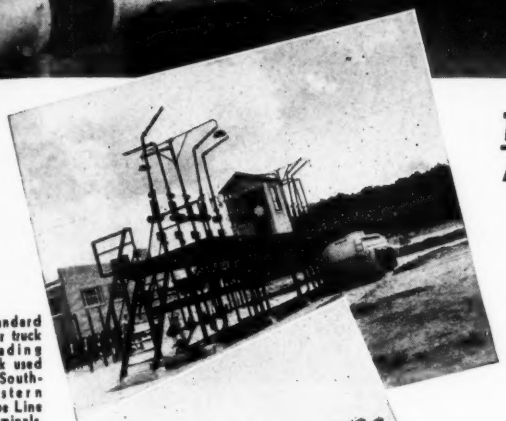
Mid-Continent Supply Company
Ft. Worth, Texas and Branches
Exclusive distributors in
Mid-Continent and Gulf Coast Areas

How PIPELINERS PROTECT PROFITS



Pittsburgh Rotocycle meters on Nordstrom valve controlled lines at Greensboro, N.C. meter station of Plantation Pipe Line.



Standard four truck loading rack used at Southeastern Pipe Line Terminals.

THEY USE ROTOCYCLE METERS TO ACCOUNT FOR ALL THROUGH-PUT

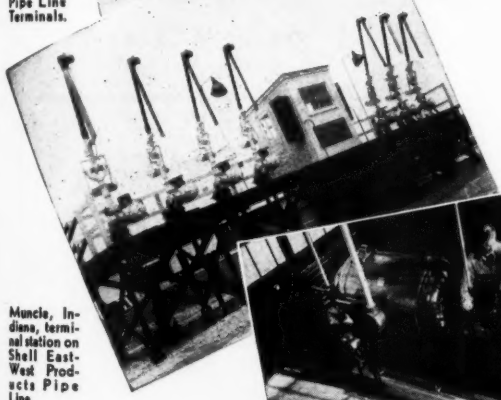
A vast network of petroleum pipe lines now encompass the country. Rotocycle meters stand guard at input and dispersal points on a majority of the leading product pipe lines. They protect the profits. And they guide the handling of multiple products through the same line.

The word has spread that Rotocycle design and construction is *right* for this service. Facts and figures compiled over the years prove their superiority in terms of sustained accuracy, durability and low maintenance costs.

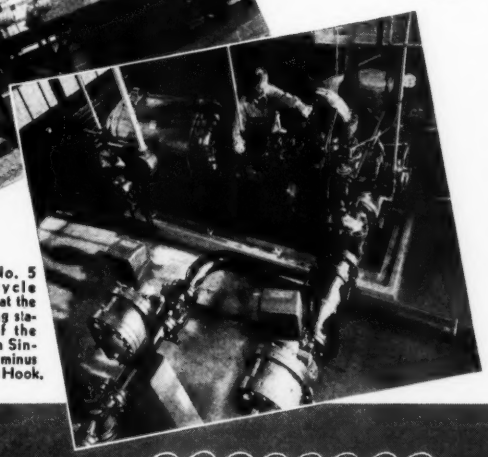
Want to see these records; learn more about this purpose-built design? Just write the nearest District Office.

PITTSBURGH EQUITABLE METER DIVISION
Rockwell Manufacturing Company
PITTSBURGH 8, PA.

Atlanta Boston Chicago Houston Kansas City Los Angeles
New York Pittsburgh San Francisco Seattle Tulsa



Muncie, Indiana, terminal station on Shell East-West Products Pipe Line.



Two No. 5 Rotocycle meters at the pumping station of the eastern Sinclair terminus Marcus Hook.

No. 6 Rotocycle meter with printing register.

PITTSBURGH *ROTOCYCLE* PIPE LINE METERS

Wherever EXPLOSIVE FUMES *are present...*

Wagner *type HP* Motors give added protection...

For safe, dependable drives in explosive atmospheres, Wagner type HP Motors are a sound choice...

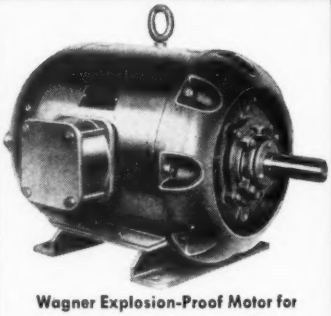
They have Underwriters' Laboratories approval for Class I Group D hazardous locations, where open-type motors might prove dangerous. They are *fully protected* against rain, snow, heat and dirt—so often found in oil fields. And they are unusually dependable!

These are three good reasons why Wagner type HP Motors were chosen to power the pumps, shown in the photo above, which are in continuous service twenty-four hours a day.

In addition, these protected-type motors are extremely economical to maintain—all that is required is periodic inspection and lubrication.

It will pay you to choose Wagner Motors for your next installation. They are a lasting investment. Twenty-nine sales and service branches, in principal cities are ready to help you on any motor problem.

Write for Bulletin MU-185 for information on the complete line of Wagner Motors.

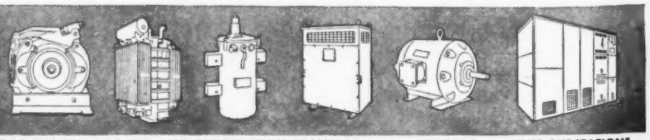


Wagner Explosion-Proof Motor for hazardous-location motor drives.

Wagner Electric Corporation
6389 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

Wagner Electric Corporation
EST. WE 1891

Consult Wagner Engineers on all Electric Motor Problems



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL AND AUTOMOTIVE PRODUCTS

A48-19

1000 CFM THROUGH 100,000 CFM

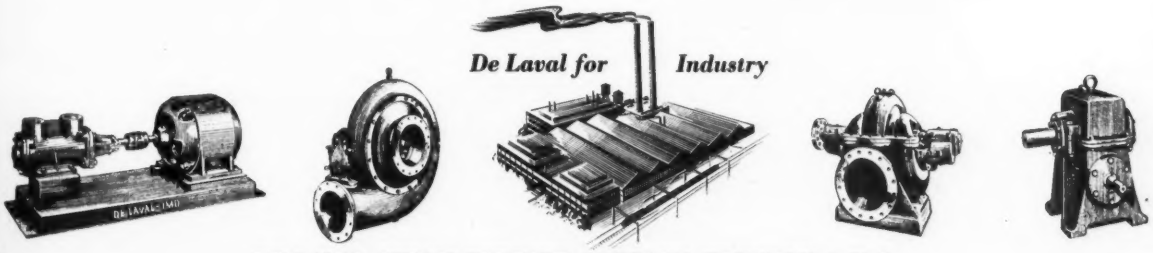
AIR AS YOU WANT IT!

For air or gas delivered as you want it, in controlled volumes through 100,000 cfm, against constant or varying pressures —call upon De Laval.

De Laval blowers, compressors and exhausters are made in a wide range of sizes, both single and multi-stage for either constant or variable speed drive, the latter of which can be furnished by steam turbine, variable speed coupling, or DC motor.

For information concerning the compression and flow of air and gases, write for Catalog F.

DE LAVAL



DE LAVAL STEAM TURBINE COMPANY, TRENTON 2, N. J.

C-10

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

FOR *Good* SERVICE . .

Look for the Green Triangle

PLUS *Quality* EQUIPMENT

The Continental organization was founded on the precepts that its success and growth depended upon giving the oil and gas industries a representative line of *quality* equipment . . . and *good* service. Continental's steady, yet unhurried, expansion has proved this policy's soundness.

Today "The Green Triangle" is a familiar—and looked for—sign throughout the oil country.

REPRESENTING THESE OUTSTANDING MANUFACTURERS

BRODERICK & BASCOM ROPE COMPANY
CHAMPION SPARK PLUG COMPANY
CLIMAX ENGINEERING COMPANY
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GRINNELL COMPANY, INC.
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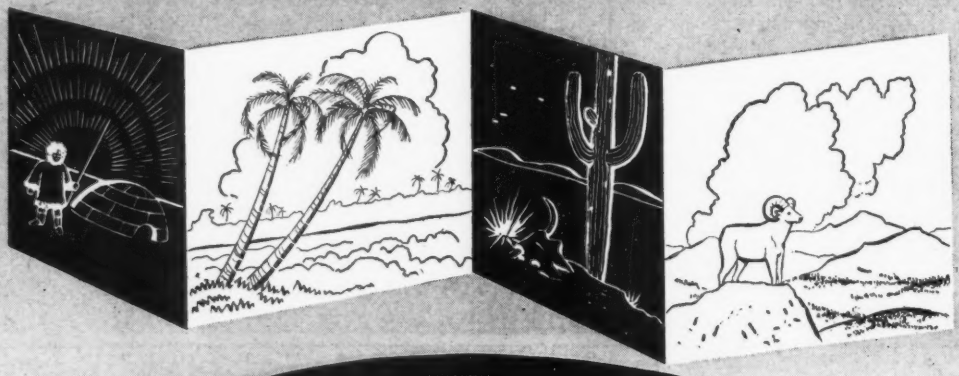
Any place is HOME



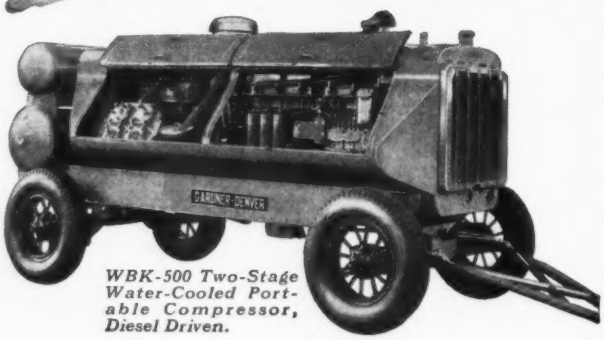
. . . to a *Water-cooled* portable

HOME is wherever you send a Gardner-Denver All Water-Cooled Portable to give uninterrupted service. For the *complete* water jacketing of all cylinders "weather-conditions" them for outstanding performance around the world . . . in hot climate or cold . . . at high or low altitudes.

Gardner-Denver Portables at work in all lands deliver cooler air . . . start easier in cold weather . . . use less lubricating oil . . . save wear and tear on air hoses. And don't forget, wherever these compressors go, they are backed by Gardner-Denver Service—all over the world.

For complete information, write Gardner-Denver Company, Quincy, Ill.

WHF-210 Two-Stage Water-Cooled Portable Compressor, Engine Driven.



WBK-500 Two-Stage Water-Cooled Portable Compressor, Diesel Driven.

Dallas • Houston • Tulsa • St. Louis • Los Angeles • San Francisco • New York
Chicago • Pittsburgh • Denver • New Orleans
Continental Supply Co., Continental Bldg., Dallas, Tex.
Republic Supply Co. (of Calif.), 2122 E. 7th Street, Los Angeles, Calif.

GARDNER-DENVER SINCE 1859

for
PIPE LINE
BOOSTER
SERVICE

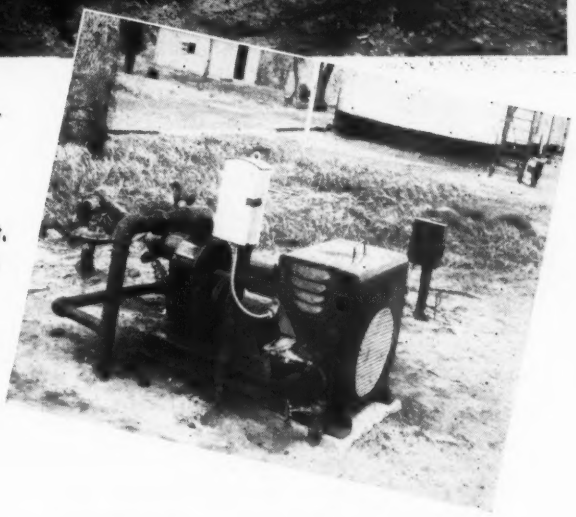
FOR THESE GOOD REASONS

FREE-FLOW DESIGN

No wasted motion in a Marlow. Here's fast, positive self-priming action... no by-passes, no auxiliary priming devices, no vapor-locking. There's nothing to adjust. There's only one working part that moves. Inside the pump, there's no metal-to-metal contact. And because a Marlow is direct-coupled to motor, there's no gear reduction needed. Wear is minimized all around.

IMPROVED SHAFT SEAL

Dependable for handling hazardous volatile liquids, Marlow's exclusive shaft seal adjusts itself automatically to changes in internal pump pressure. It won't drip. It requires no special lubrication or attention. It does away with stuffing box problems and maintenance.



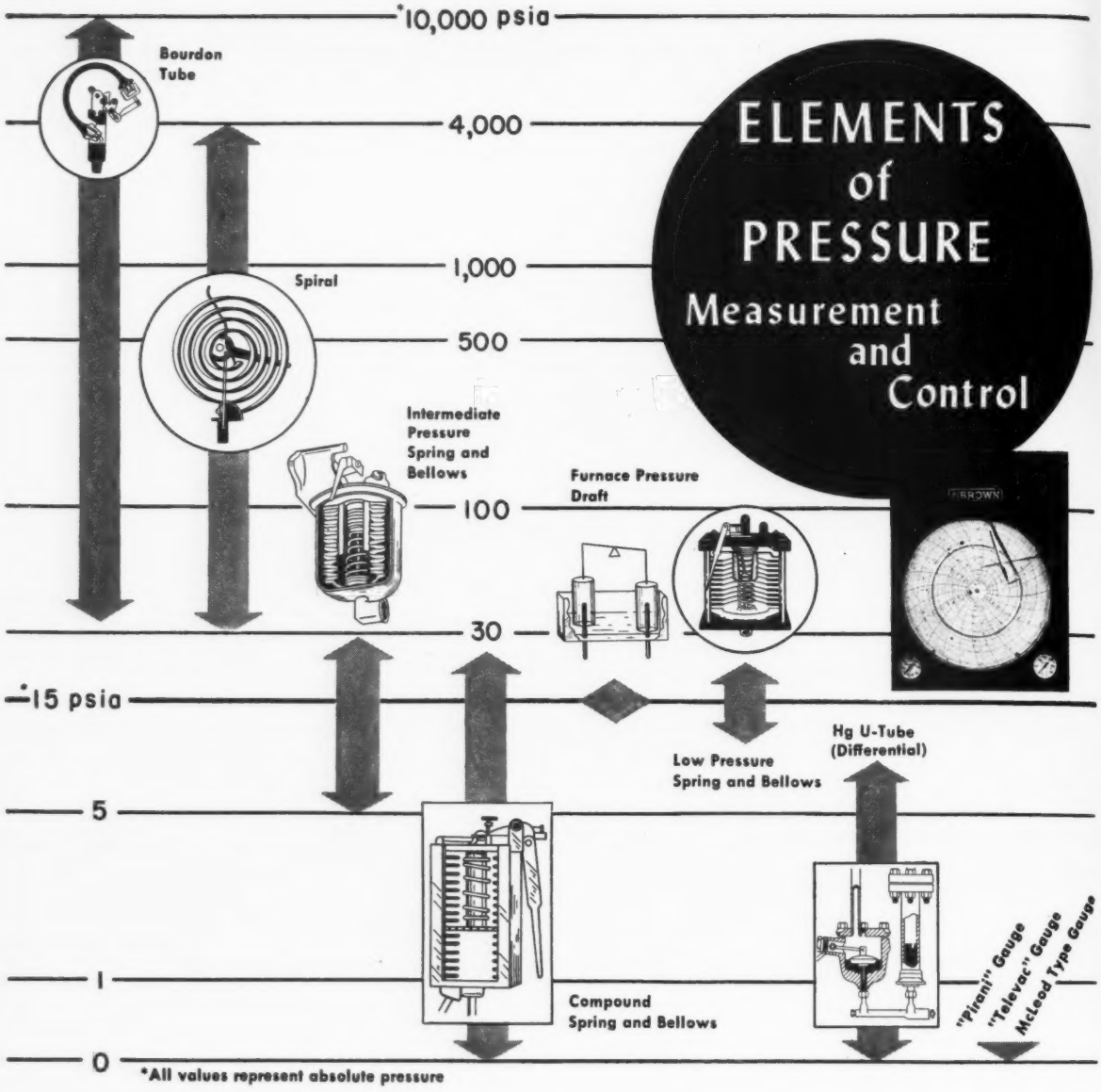
Handling 120 barrels per hour at 43-lb. pressure with practically no attention. This Marlow Self-Priming Centrifugal recently joined hundreds of others now in oil field gathering service. In this Shawnee, Oklahoma, installation, a Model 37 HEL-2 is direct-coupled to an Onan engine with weather housing added. These units are used to transfer oil from isolated tank batteries to the suction side of the main gathering system pump.

See your Marlow distributor or write for detailed literature. Get *all* the reasons why the trend is to Marlow pumps for booster service in pipe line gathering systems.

MARLOW PUMPS

RIDGEWOOD, N. J.

Midwestern Office: 226 E. 4th St., Tulsa 3, Oklahoma



FROM tons to microns—never underestimate the importance of precise pressure control of your processes. The effect of slight pressure inaccuracies has proven to be more far-reaching than is commonly suspected.

Proper handling of pressure problems necessitates a full line of pressure elements—not just making one element do for a variety of applications. The complete line of pressure equipment, and broad knowledge of its application, available through The Brown Instrument Company is unsurpassed.

Accuracy and control quality are part of the story; minimum hysteresis effect and far greater over-load protection are additional factors that make Brown Pressure Gauges *the finest available to industry today.* An interesting catalog on pressure gauges is now available. Send for Catalog 7000.

THE BROWN INSTRUMENT CO., 4488 WAYNE AVE., PHILADELPHIA 44, PA.

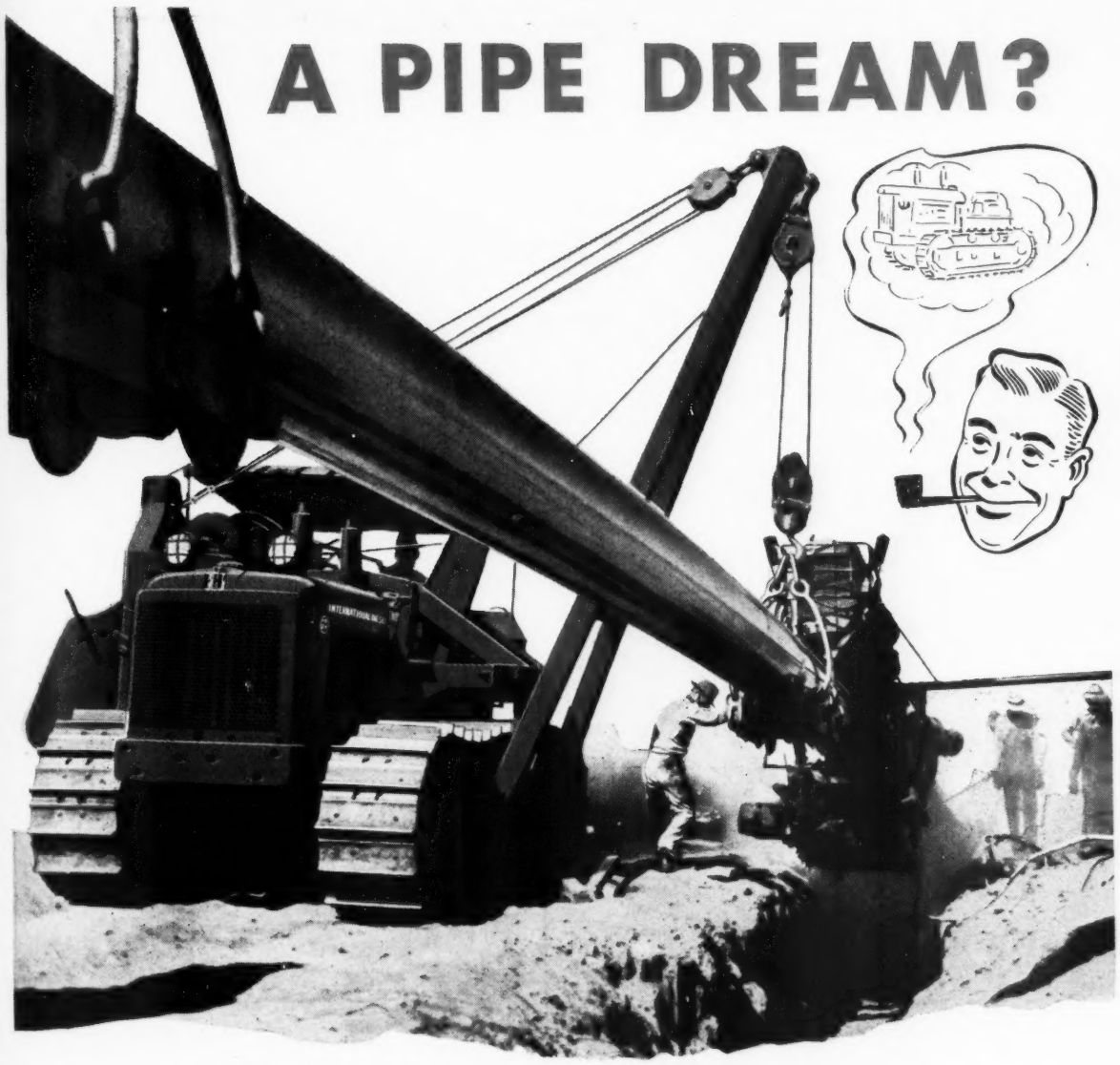
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

Offices in principal cities of the United States, Canada and throughout the world.

BROWN *Advanced Instrumentation* **FOR BETTER PROCESSING**

Product of MINNEAPOLIS Honeywell

A PIPE DREAM?



Yes, you might call the TD-24, "A dream on a pipeline job." Owners and operators do!

This TD-24 is supporting 20-inch pipe and a wrapping machine on a Morrison Bros. spread near Kermit, Texas. The soil is sandy desert, but, as operator Emmett Wilkerson says, "—both tracks under power on turns are a great help—won't bog down. The weight and power of the TD-24 allows us to work a heavy load farther from the ditch, preventing cave-ins."

You see, the TD-24 really is a "dream tractor." It has tremendous power — *more than any crawler built.* And it has dozens of other features: Hydraulic steering with power on both tracks, instant high-low range shifting, eight speeds forward and eight reverse—these are just a few of the exclusive TD-24 features.

A visit to your International Industrial Power Distributor will show you that when it comes to power and performance—the TD-24 is *unmatched.* And that's no *pipe dream!*

Industrial Power Division

INTERNATIONAL HARVESTER COMPANY

180 North Michigan Avenue Chicago 1, Illinois

Listen to "Harvest of Stars" every Wednesday on your CBS station.

Standardize on Power that Pays

INTERNATIONAL

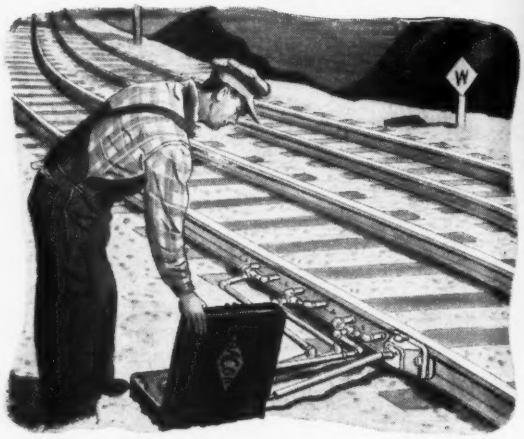
INDUSTRIAL POWER

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS

Let Morse grease the rails for *your* tough jobs too!

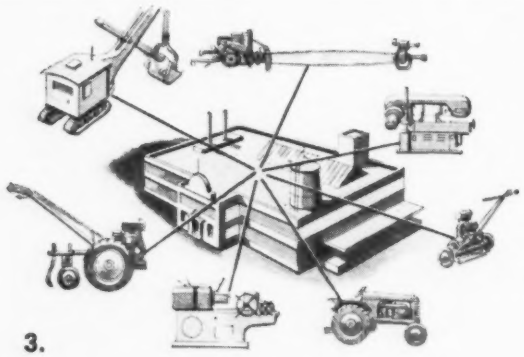
1.

Sc-r-r-ee-ch! Railroad men know this noise means that expensive train wheels and rails are wearing away on curves. To prevent this wear, automatic greasers were installed to lubricate wheels and rails. Old-style ratchet type clutches were tried, but slipped or didn't feed grease right. American Brake Shoe Company's Ramapo Ajax Division solved this knotty problem . . .



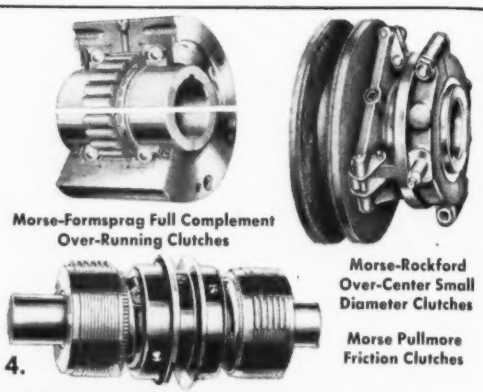
2.

They now use Morse-Formsprag Clutches. The positive action of Morse-Formsprag Clutches is far superior in performance, dependability and service over the old ratchet type. *M-F Clutches engage instantly; allow no back-slip; feed grease to every passing wheel.* Other complex operations on your products may call for Morse-Rockford Friction Clutches . . .



3.

Morse clutches fill almost every need you can imagine. Can the sales and mechanical value of your own products be enhanced by using Morse clutches? Leading manufacturers of such items as construction equipment, cultivators, saws, pumps, lawn mowers and machine tools have bettered *their* products with Morse clutches. How about you? Do this now . . .



Morse-Formsprag Full Complement Over-Running Clutches

Morse-Rockford Over-Center Small Diameter Clutches

Morse Pullmore Friction Clutches

4.

Write for expert clutch engineering aid and consultation. For new ideas, send for clutch catalogs: Morse Formsprag Clutch Catalog, No. C11-48; Morse Pullmore Clutch Catalog, C31-47; Morse-Rockford Clutch Catalog, SDOC. Address: Morse Chain Company, Department 220, 7601 Central Avenue, Detroit 8, Michigan.

Morflex Couplings

Roller Chain Couplings

Silent Chain Drives

MORSE

MECHANICAL POWER TRANSMISSION PRODUCTS

A PRODUCT OF B-W BORG-WARNER

Morflex Radial Couplings

MORSE CHAIN COMPANY • DETROIT 8, MICHIGAN

BRANCH OFFICE AND WAREHOUSE, 1308 LA BRANCH, HOUSTON, TEXAS

A NEW HIGH ...IN BRONZE GATE VALVE DESIGN

LUNKENHEIMER

200 LB. BRONZE *UNION BONNET*

GATE VALVE

The new Lunkenheimer 200 Lb. Bronze Union Bonnet Gate Valve incorporates the first application of full cylindrical body sections in bronze gate valves. This construction, previously used only in higher pressure steel valves, provides great strength and maximum resistance against distortion of the valve body and seats due to internal pressure strains and other stresses. Tests made under the most severe conditions prove that this design will not distort and will maintain initial proportions and seat tightness.

In addition to the cylindrical body construction and other service-giving features, these valves employ Lunkenheimer's patented Alloy Stems which eliminate stem thread failure due to wear.

ESTABLISHED 1862

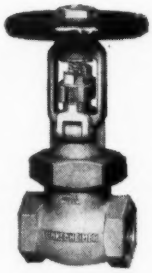
THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

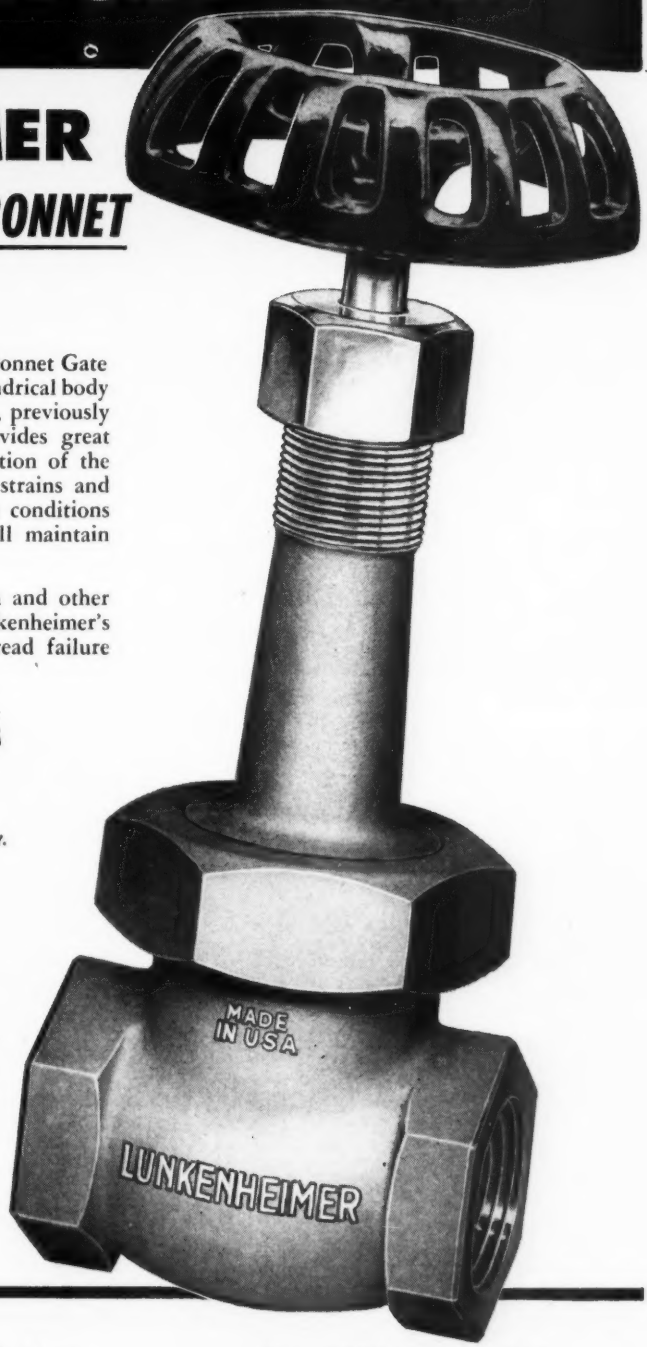
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34

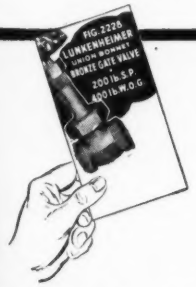
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.



O. S. & Y.
Union Bonnet
¾ to 2 inches
Fig. 2232—Screw Ends
Fig. 2233—Flange Ends
Wedge Disc,
Rising Stem

Union Bonnet
¼ to 2 inches
Fig. 2230—Screw Ends
Fig. 2231—Flange Ends
Wedge Disc,
Non-rising Stem

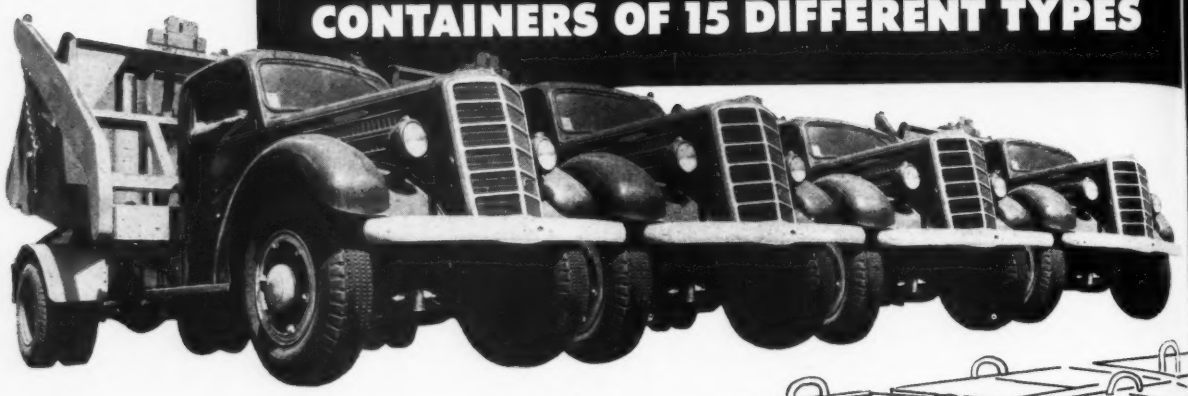


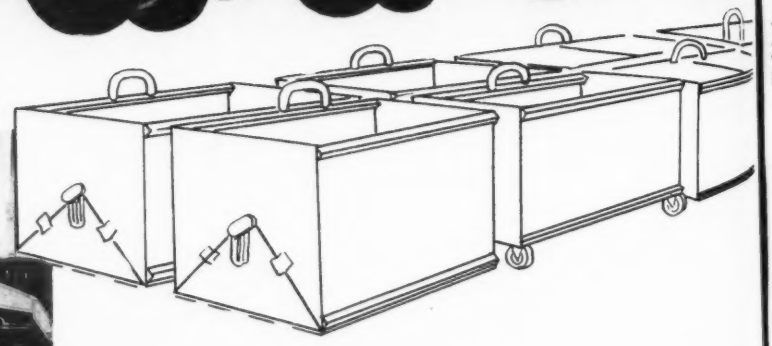


Complete information is given in Circular No. 534. Ask your Lunkenheimer Distributor for a copy or write us direct.

Fig. 2228—Screw Ends
Fig. 2229—Flange Ends
Double Disc
Rising Stem

THESE FOUR TRUCKS HANDLE 88 CONTAINERS OF 15 DIFFERENT TYPES





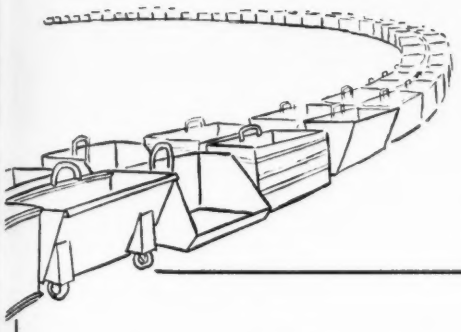
Like many industrial operations, this refinery extends over many acres and handles great quantities of materials, in addition to hundreds of cubic yards of scrap and rubbish daily. Choosing strategic points for receiving material, the 88 containers were placed throughout the refinery, the requirements at each point determining the size and number of containers to be used. At some points for liquid, water-tight containers with lids were required. At others, light, bulky waste called for a big capacity, light-weight enclosed container. Some accumulation points were inside buildings. Containers on casters that could easily be rolled indoors were provided. Each container is assigned to one of the four truck hoisting units and, on a synchronized schedule, is picked up as soon as it is filled. Photos at left show: top-truck hoisting unit backing up to a 6 cu. yd. Universal container. The driver attaches two chains, and then, from controls in the cab, the container is hydraulically lifted into carrying position (see photo at left center). Arriving at the disposal area, the container is automatically dumped (see photo left below). The container is then returned to its original point for reloading and the truck hoisting unit moves on to the next container on its route. Pick-up and dumping operations require only a matter of seconds, thus it is possible for one man and one truck to handle any number of containers, keeping a steady flow of material moving without waiting or wasting time.

On opposite page are illustrated the types of containers in the original installation and the materials they handle. Note how easily the basic Dempster-Dumpster containers are converted for special purposes by the simple addition of lids, casters or some other special change.

The Dempster-Dumpster system is saving money in large and small plants alike. Its great flexibility makes it adaptable to any plant, regardless of size, and assures tremendous savings along with amazing improvements in efficiency. A survey of your plant, without charge or obligation, could reveal the amazing effectiveness of the Dempster-Dumpster System.

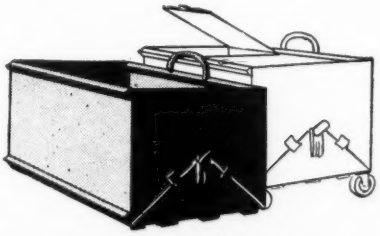
DEMPSTER BROTHERS, Inc.

. . . THIS IS THE DEMPSTER-DUMPSTER SYSTEM
. . . SAVES THIS REFINERY $58,000 ANNUALLY

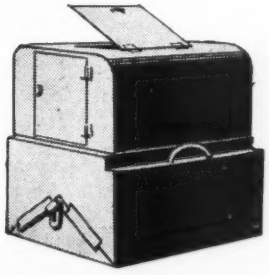


The Dempster-Dumpster System of Materials Handling, simply stated, permits the use of any required number of detachable containers, of various designs and capacities, to be serviced by a single truck. Its ability to effect tremendous savings in handling numerous types of materials has been definitely established in hundreds of leading industrial plants.

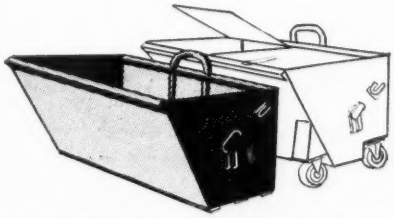
In this particular case, in a large refinery, four of the twelve trucks formerly detailed for materials handling, including scrap and rubbish collection, were equipped with Dempster-Dumpster Hoisting units to handle 88 detachable containers of 15 different types. The Dempster-Dumpster System of quick pick-up and dumping of pre-loaded containers has worked wonders in efficiency, plant appearance, and savings. In one year savings of over $58,000 was shown by our engineers survey. Time has proved the correctness of this survey. Since the original order of 88 containers, so many more uses for the equipment and greater savings were discovered that 55 additional containers have been placed in service with a grand total of 143 containers now being handled by the four trucks.



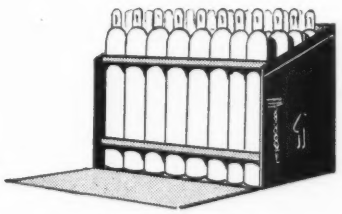
DROP BOTTOM CONTAINERS. 48 drop-bottom containers were furnished for handling trash and rubbish, steel turnings, scrap metal, tube ends and clay:—Twenty 6 cu. yd. open top type, one 6 cu. yd. with lids, nine 2½ cu. yd. open top type, two 2½ cu. yd. open top with casters, six 3 cu. yd. open top, nine 4 cu. yd. with lids, one 4 cu. yd. enclosed with hinged door in top.



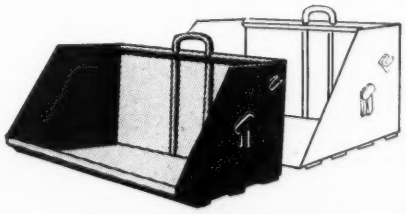
UNIVERSAL CONTAINERS. 13 universal containers were furnished for handling trash and rubbish. Universal containers feature completely enclosed construction, drop-bottom dumping, a door in either end for ground-level loading and a lid in the top for loading from a platform.



TILT TYPE CONTAINERS. 16 tilt type containers were furnished for handling general refuse, sludge and settlings:—Four 3 cu. yd. open top type, nine 3 cu. yd. with lids, three 3 cu. yd. with lids and casters.



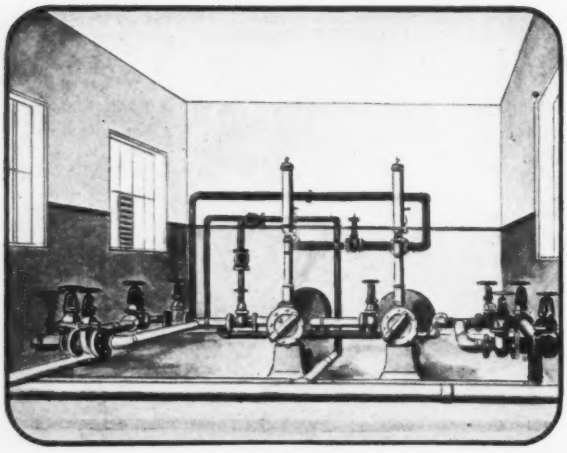
SPECIAL CONTAINERS. 3 special containers were furnished for handling and transporting oxygen cylinders from one point to another in the refinery. This container is typical of the many highly specialized uses for which Dempster-Dumpster containers are constructed. Many other containers are available for handling almost any type of material known, be they liquid, dust, light or bulky or very heavy materials.



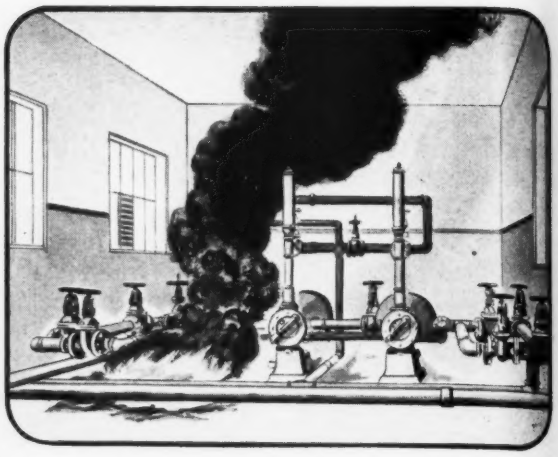
SKIP TYPE CONTAINERS. 7 skip type containers were furnished for handling refuse wax, oil, lube and coal:—Three 3 cu. yd. skip type with lid, three 3 cu. yd. skip type without lid, one 3 cu. yd. skip type with teeth.

DEMPSTER DUMPSTER
TRADE MARK REG.
SYSTEM

598 Dempster Building, Knoxville 17, Tennessee



In pump rooms for solvents or petroleum products—



flames can gain headway in seconds—

STOP THEM DEAD IN THEIR TRACKS

THE *Kidde* WAY!

Just a slight leak in a pump room handling flammable liquids—and you've a spot where a damaging fire can start. Give your pump rooms the best in fire protection—safeguard them with *Kidde** Total Flooding Systems!

The dry, clean carbon dioxide (CO_2) from a *Kidde* System automatically or manually operated—quickly pours into the room. The flames can be extinguished in a few seconds!

CO_2 cannot damage your pumping equipment—leaves no after-fire mess to clean up.

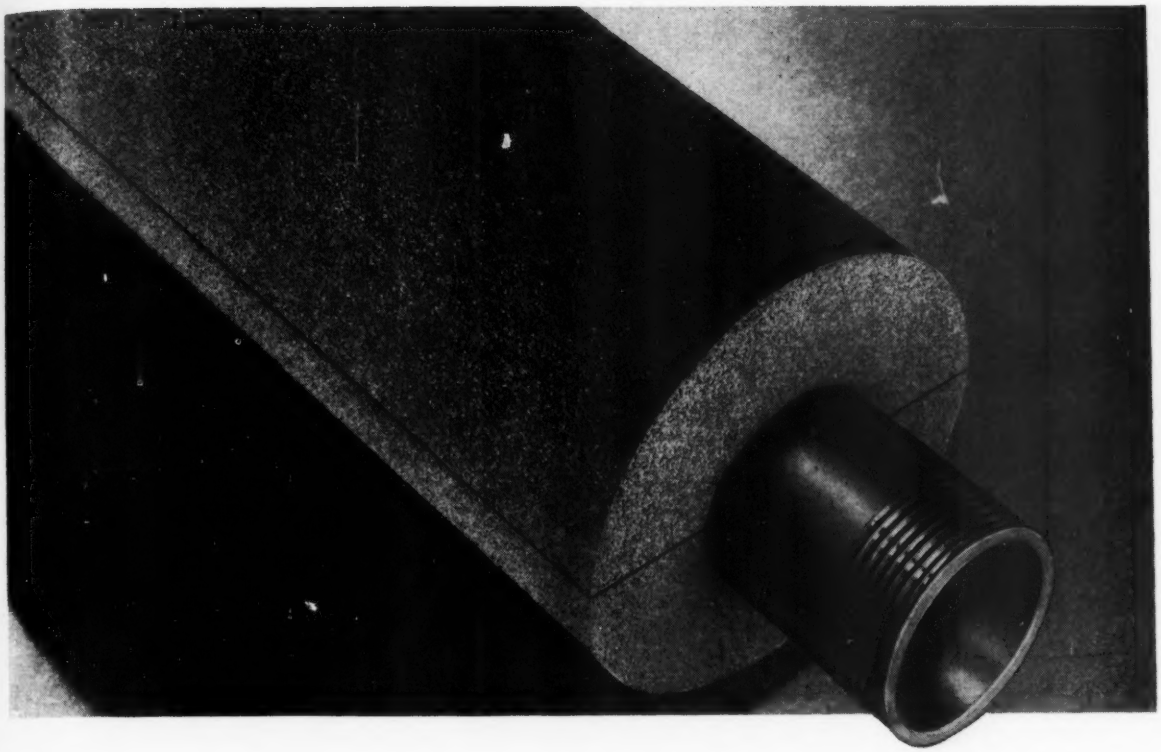
Kidde Total Flooding Systems now use the *exclusive* Multijet Nozzle—one replaces several old-type nozzles, makes installation simpler. Ask a Kidde representative for full details.

*Also known as "LUX."

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

Walter Kidde & Company, Inc. • **954 Main St., Belleville 9, N. J.**



for Cold piping · for Hot piping

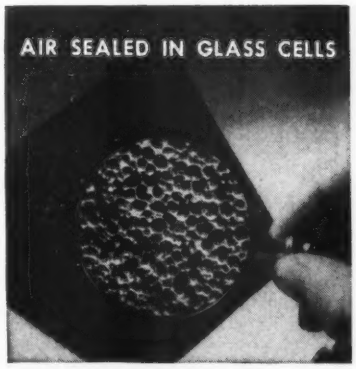
one permanent insulation

● PC Foamglas is the only insulation that can be used for both hot and cold pipe lines, indoors and outdoors. In its cellular glass structure lies the secret of its excellent insulating qualities, which help to retain or exclude heat.

PC Foamglas insulation is waterproof, fireproof and vaporproof. You need no expensive vapor and weather protection, have no maintenance and replacement costs. When installed according to our specifications for recommended applications, PC Foamglas retains its original insulating efficiency *permanently*.

For pipe insulation PC Foamglas comes in easily handled sections, strong, rigid, light in weight, easy to cut and fit with ordinary tools, right on the job. Prefabricated tees, elbows and valve covers are available. Also the big oblong blocks of PC Foamglas — and the special shapes that are available—can be fabricated to fit special applications.

When you are considering insulation for hot or cold piping, be sure you have complete information on PC Foamglas. Just send in the coupon and we shall be glad to send you a free copy of our recent folder.



THE MAGNIFIED CROSS SECTION of PC Foamglas shows its cellular structure . . . glass bubbles solidified into big, strong, rigid blocks. In the millions of cells of glass-enclosed air lies the secret of its insulating value.

Pittsburgh Corning Corporation
Room 506-8, 632 Duquesne Way
Pittsburgh 22, Pa.

Please send me without obligation, your FREE folder on the use of PC Foamglas Insulation for hot and cold piping.

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City_____ State_____

When you insulate with FOAMGLAS... you insulate for good!

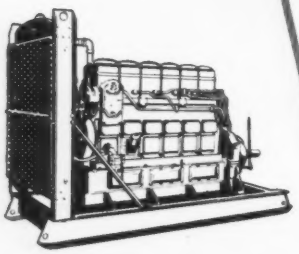
PITTSBURGH ® PC CORNING

Pittsburgh Corning Corporation also makes PC Glass Blocks

FOAMGLAS INSULATION

FOR ADDITIONAL INFORMATION SEE OUR INSERTS IN SWEET'S CATALOGS

PIPE LINE POWER



CUMMINS DIESELS ARE DEPENDABLE

The Series L Cummins Diesels feature a 7" bore, 10" stroke and 2309 cu. in. piston displacement. These engines are rated 240 hp at 900 rpm for most oil field applications and have a maximum rating of 250 hp at 1000 rpm. Series L engines are recommended for continuous duty where horsepower requirements do not exceed 175 hp at 800 rpm.

ALSO COMPLETE STOCKS OF VALVES, FITTINGS, AND PIPE LINE SUPPLIES

MUST BE ECONOMICAL, DEPENDABLE and FLEXIBLE

Pipe Line power must be dependable —that's Cummins—it must be economical—that's Cummins—and it must be flexible—that also is Cummins. That is because Cummins Dependable Diesels are built for the premium jobs, tough jobs where dependable operation and low cost maintenance over long periods of uninterrupted service determine the margin of profit. Consider Cummins Diesels for all of your power requirements.

CUMMINS Dependable DIESELS
SINCE 1919, PIONEER OF PROFITABLE POWER THROUGH HIGH SPEED DIESELS

MID-CONTINENT Supply Company

General Offices Mid-Continent Bldg. **FORT WORTH, TEXAS**

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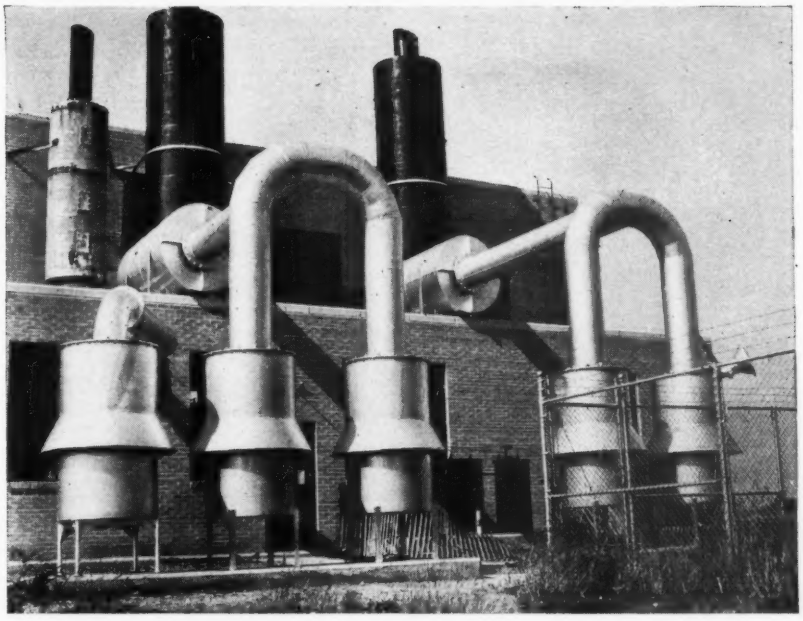


...but not from damaging dust

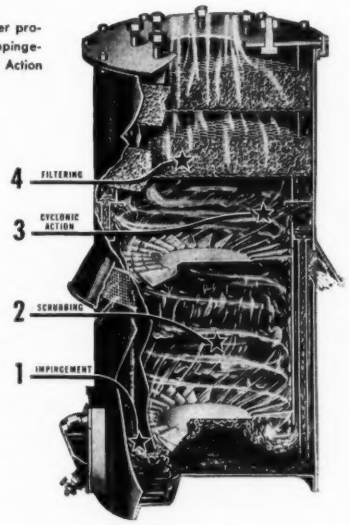
Cycoil Oil Bath Air Cleaner provides 4 way cleaning—Impingement, Scrubbing, Cyclonic Action and Filtering.

Filtration through Double Cells completes cleaning action eliminating oil mist from air.

Cyclonic action induced by vanes throws oil containing dust outward.

Scrubbing action, thoroughly mixes air and oil, entraining all dust particles.

Impingement of dirty air against oil, deposits the heavier dust particles immediately. Oil and air mixture then passes upward with whirling motion through vanes to succeeding cleaning steps.



*Trade-mark registered U. S. Patent Office

Cycoil Oil Bath Air Cleaner Eliminates Costly Dust Damage to Engines and Compressors

WISE operators have learned that free air can be mighty costly when loaded with dust and dirt. That's why thousands of engines and compressors are today equipped with Cycoil* Oil Bath Air Cleaners to insure that the air is truly free from these trouble-making particles.

The Cycoil Oil Bath Cleaner leaves nothing to chance. This heavy-duty unit is built to deliver practically 100% dust removal efficiency. Over 90% of the total fine dust content of the air is trapped in a Cycoil even before reaching the filter cell. Positive oil circulation for continued self-cleaning action, plus the additional filtration to be had in the filter pads, assures approximately 100% clean air.

It's a matter of record that wherever Cycoils are on the job at the intake, outgo for costly repairs and shutdowns due to dust damage is a thing of the past. Write today for Cycoil Bulletin 130-D and names of prominent users.

AMERICAN AIR FILTER COMPANY, INC.
444 Central Avenue, Louisville 8, Ky.
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AAF Cycoil® OIL BATH AIR CLEANER
AND INTAKE SILENCER

These Pipe-line Jobs Move Faster with Bucyrus-Erie Bullgraders

1. Clearing the Way

The strength and toughness of a Bucyrus-Erie Bullgrader plus the easy, handy blade adjustments make quick work of pioneering the right of way. With the blade angled and tilted, it's easy to tear out underbrush, rough grade the ground, sidecast both brush and dirt out of the way. Perfect matching of equipment to tractor lets the operator call on all the tractor's power in roughing out the pipe-line path.

2. Backfilling the Trench

The operator gets the breaks when it comes to backfilling, too. Bucyrus-Erie design affords plenty of visibility, speeds up the job because the operator can watch the work as the scientifically curved blade rolls dirt into the trench. Accurate blade control eliminates waste motions.

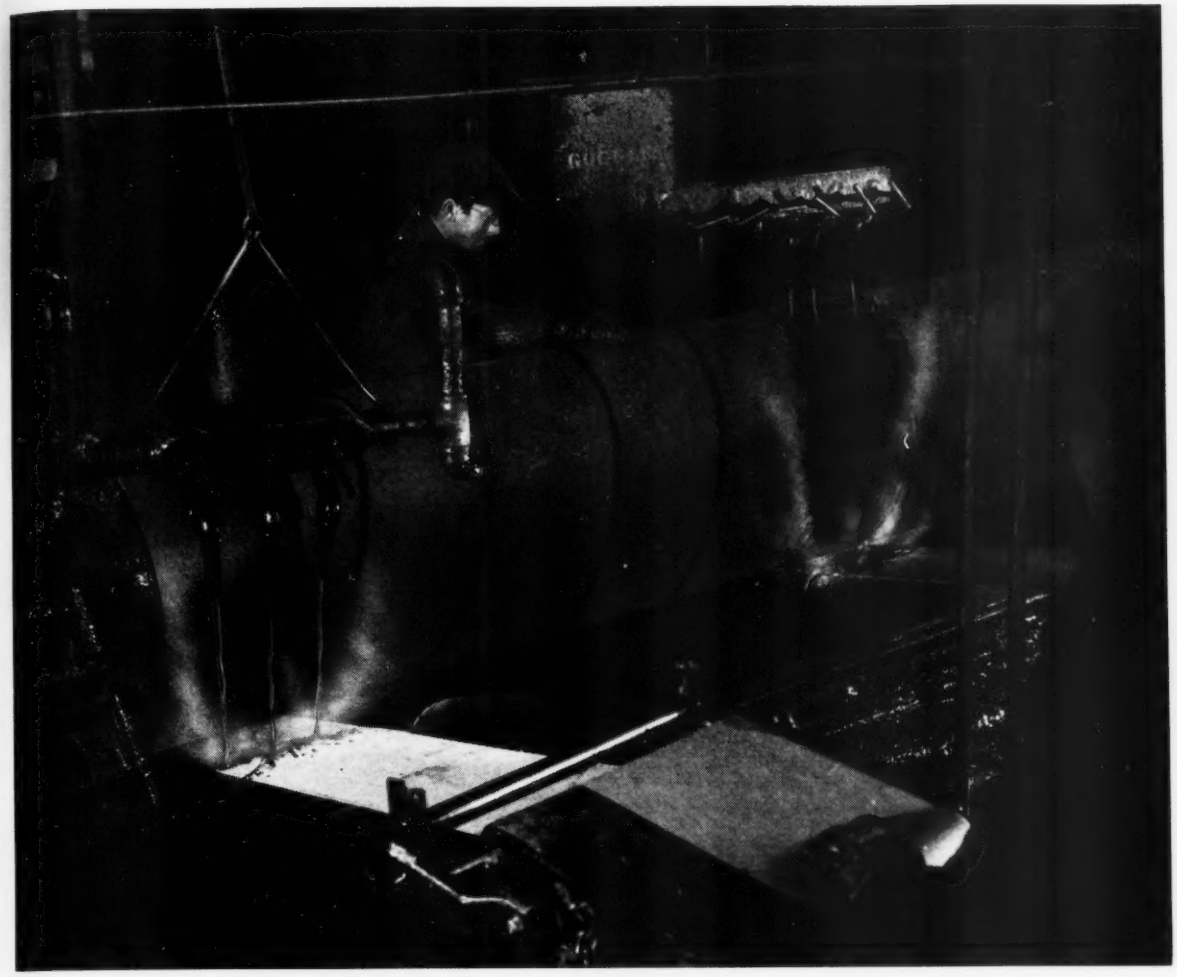
3. Clearing up the Job

When the trench is covered, your operator will find the Bullgrader is the handiest of tools for whipping through the clean-up phase. He gets maximum grading accuracy because the interconnected cylinders keep the blade from being affected by track oscillation. The blade "float" position makes it easy to smooth out the grade, too. See your International Industrial Tractor distributor for full details. Bucyrus-Erie Company, South Milwaukee, Wis.

BUCYRUS ERIE

122T48

See Your INTERNATIONAL Industrial Tractor Distributor



How To Permanently Protect Your Pipe Lines

from the ravages of rust

Here is 24-inch pipe being prepared to resist corrosion with NO-OX-ID and NO-OX-IDized Wrapper. The pipe was precoated with NO-OX-ID 2C Primer at the pipe mill for protection in transit.

The very efficient equipment in this coating yard rotates the pipe and moves it from right to left. Just right of the center of the picture, NO-OX-ID XX is being applied to the primed pipe at a temperature of 325°, followed by spiral wrapping of NO-OX-IDized #7 Asbestos Wrapper.

At the left, #14 Service Coat and Kraft Paper are being applied simultaneously over the NO-OX-ID combination for further protection against soil stress and during the actual laying operation.

Dearborn technicians will be glad to consult with you on any job you may have up involving the laying of new lines or the maintenance of existing lines which may need attention.

NO-OX-ID IRON-RUST REG. TRADEMARK AUG 27 1918

Dearborn

TRADE MARK REGISTERED

CHEMICAL COMPANY

Dept. K, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

NO-OX-ID IS THE ORIGINAL RUST PREVENTIVE

HOW you and your employees can reduce this inflationary gap

With proper guidance from top management, the nation's workers can powerfully attack inflation at its source.

One way, of course, is by increasing production. But production of most goods already has been pushed to maximum! The other approach is to reduce the volume of dollars that can be used to bid up prices on scarce goods.

There's no more effective tool for this job than the Payroll Savings Plan for the regular purchase of U. S. Security Bonds. Via this plan, 5.5 million wage earners are investing over 8% of their pay—over 100 million dollars per month—in Bonds.

What Is the Status of the Plan in Your Company?

In companies where top management backs the Plan, 35% to 50% of the employees participate, and the average total Bondholding is $1200 per family. If these figures are above those for your employees, it is apparent that the Plan needs reinvigoration by your personal sponsorship.

Benefits Accrue to the Nation and to Your Company

Every Bond dollar that is built up in the Treasury is used to retire a dollar of the national debt that is potentially inflationary. Every Bond held means fewer dollars to go to market to bid up prices on scarce goods. In addition, dollars invested in Bonds are building future purchasing power. All these factors contribute to the security of the national economy—including your business.

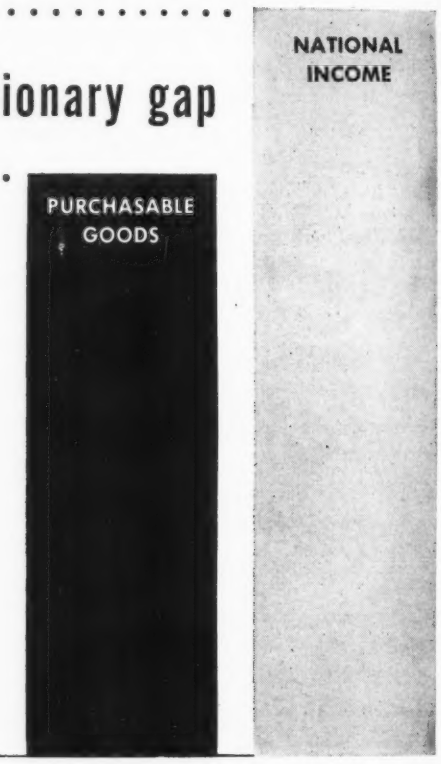
Bonds build security for individuals, because every $3 invested pay $4 at maturity.

Moreover, in 19,000 companies operating the Payroll Savings Plan, employees have proved to be more contented. Worker production has increased, absenteeism has decreased—even accidents have been fewer!

Management's Role Is Vital

Even with all its benefits, the Payroll Savings Plan requires sponsorship by top management to keep employees *aware* of the benefits. That's why the Treasury Department has prepared a kit of materials especially for you to distribute among specific key personnel. Be sure to get and use your kit—for the security of your company and your country!

For any help you want, call on your Treasury Department's State Director, Savings Bonds Division.



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Tulsa 1, Oklahoma

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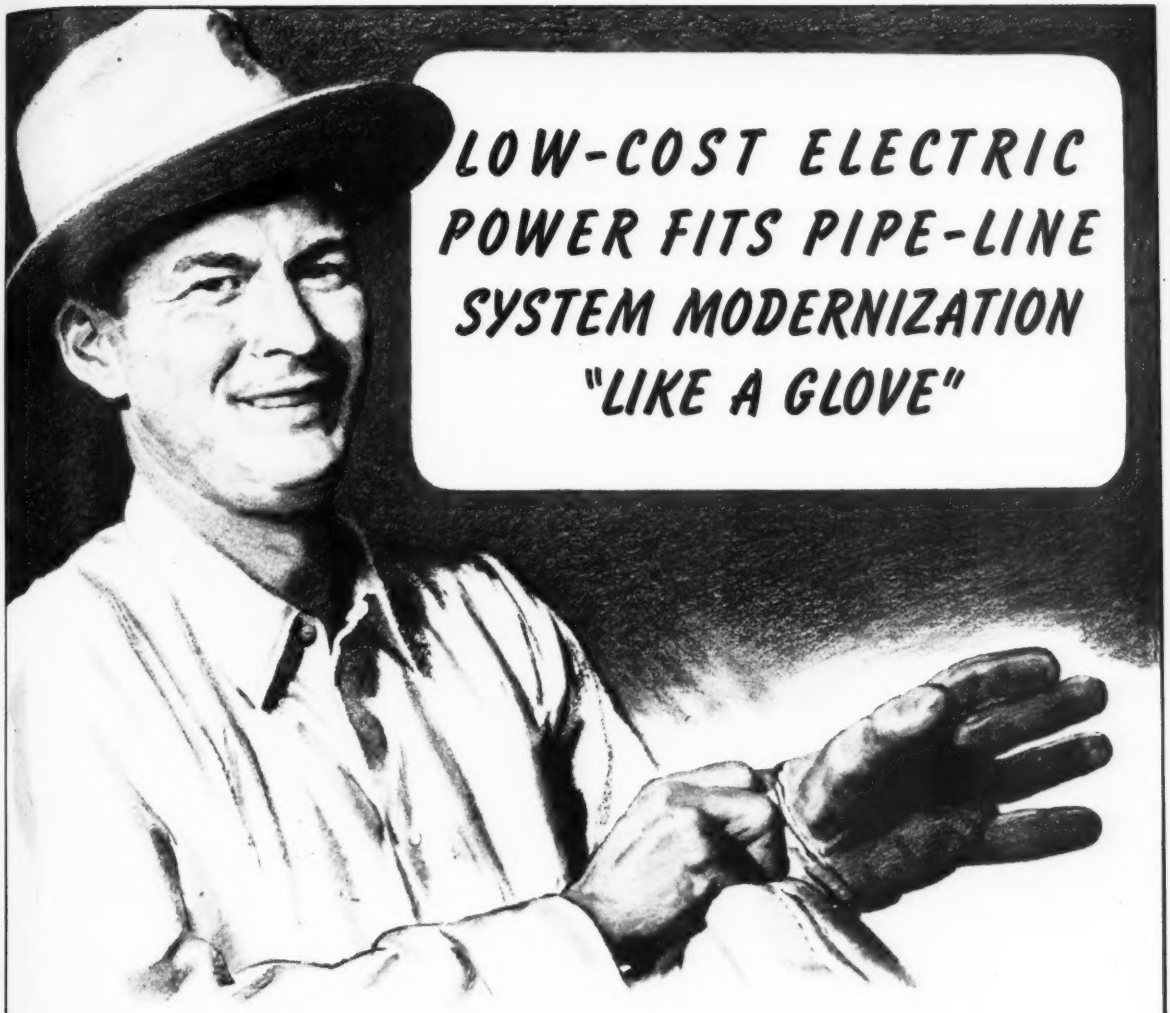
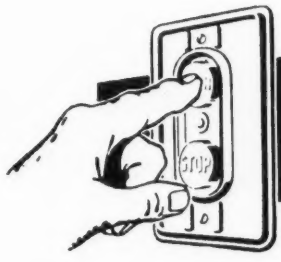


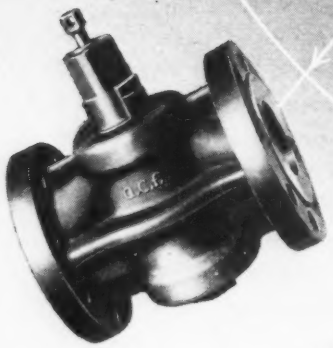
Experience gained in construction and operation of new pipe line systems proves and justifies the trend to larger diameter lines, fewer pump stations, and simplified pumping equipment. Low-cost electric power enables you to attain the fullest economy in application of these three factors. Motor-driven pumps require less initial investment . . less maintenance expense . . and less for operation and labor. A minimum of attention and supervision is necessary when you have "pushbutton control" of your pumping equipment.

Purchased electric power insures lower pumping costs.



HOUSTON LIGHTING & POWER COMPANY

Why anything other than a Cylindrical Plug Valve?



It came into being with modern precision-ground fits... High pressure grease seal... Easy to turn... Always liquid tight.

a.c.f. CYLINDRICAL LUBRICATED FULL PIPE AREA **PLUG VALVES**

Representatives in more than 50 Principal Cities

Reference Catalog No. 4-OG of types and sizes available on request. Write American Car and Foundry Company, Valve Division, 30 Church Street, New York 8, New York.

This Simple Compressor Meets the Complex Needs of a Changing Petroleum Industry

It's the Nash!

Here is a compressor presenting advantages found in no other device. Nash Compressors have only one moving part, rotating without metallic contact with the pump casing. No internal lubrication is required. Yet they produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure.

There are no valves, gears, pistons, sliding vanes, or other complicated wearing parts in a Nash. Compression is secured by an entirely different principle of operation. Because of this, gas pumping problems difficult with ordinary pumps are often easily handled by the Nash. For example, Nash Pumps are standard equipment in the Synthetic Rubber Industry, where they have met the needs of new and difficult processes.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. They maintain original performance over long periods. Service is assured by a nationwide net-work of Engineering Service offices. Instructive bulletin shows how they operate. Write for it.

One moving part.

No internal wearing parts.

No valves, pistons, or sliding vanes.

No internal lubrication.

Low maintenance.

Slugs of liquid entering pump do no harm.

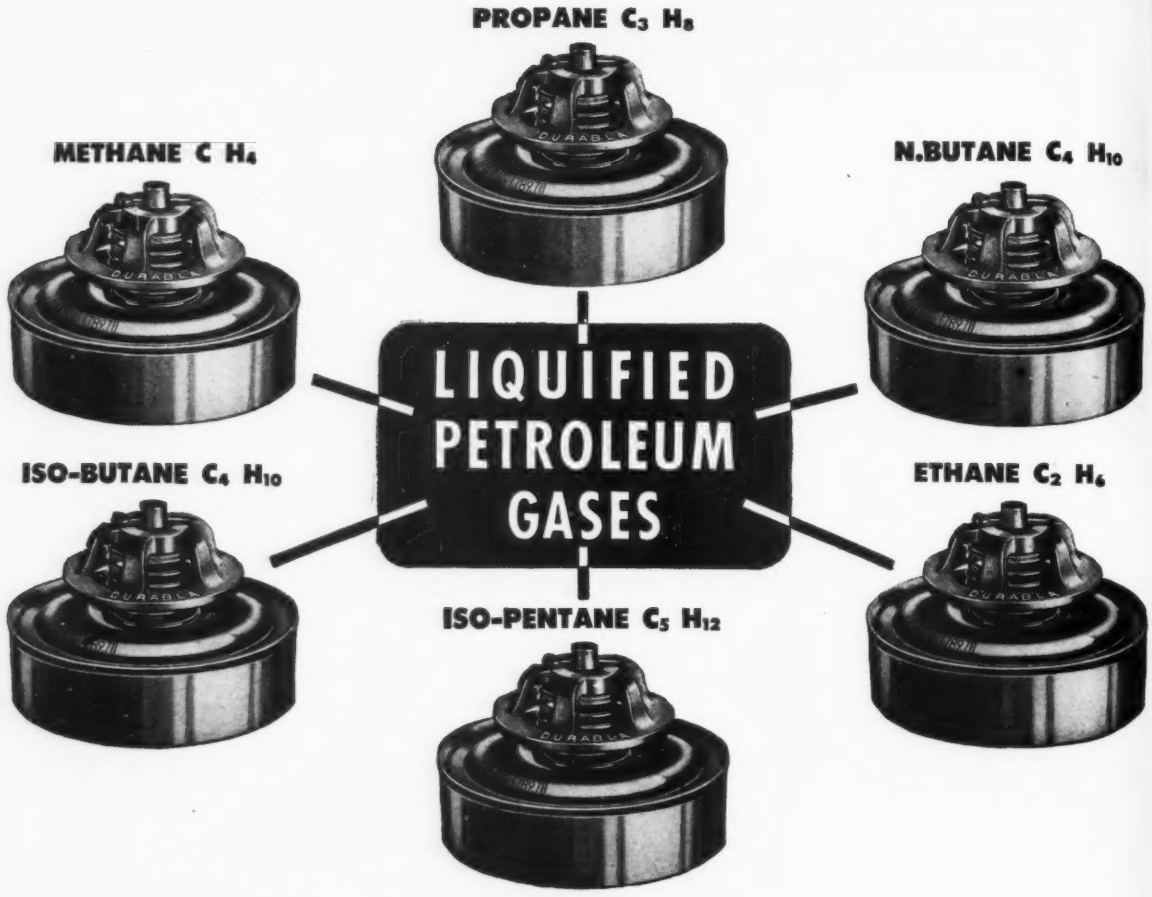
Non-pulsating pressure.

Saves floor space.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

273 WILSON, SO. NORWALK, CONN.



DURABLA PUMP VALVES FOR LIGHT HYDROCARBONS

When close clearance or any other design of reciprocating pumps are used for handling the greatly increased production of light hydrocarbons, DURABLA METAL PUMP VALVE UNITS* are your guarantee of high performance, freedom from "gassing" and replacement problems. The arched and curved shape of the valve member absolutely minimizes "slip", cavitation, and turbulence. DURABLA Valves are precision engineered, especially for this service.

Pump valves all open with a tilt action towards the flow line or line of least resistance. DURABLA Valves, being free-tilting, follow this natural law, which is not possible with high hub stem-guided valves or wing guided valves where large side friction is caused when they attempt to tilt in accordance with this basic law . . . and no other free tilting valve is as light as the DURABLA Valve.

ONLY DURABLA OFFER ALL THESE ESSENTIAL FEATURES FOR LIGHT HYDROCARBON SERVICE

- Feather Weight Valve Member
- Free-Tilting Valve Member Without Side Friction
- Snap Action Under Any Load
- Positive Seal Independent of Contraction and Expansion of Gases
- Does Not Need Lubrication
- Compact Design, Stocked in 11 Standard Sizes to Fit Any Pump

Write DURABLA Engineering Department for information and Bulletin, Reference 8G10

*Patent Numbers 2090486, 2117504

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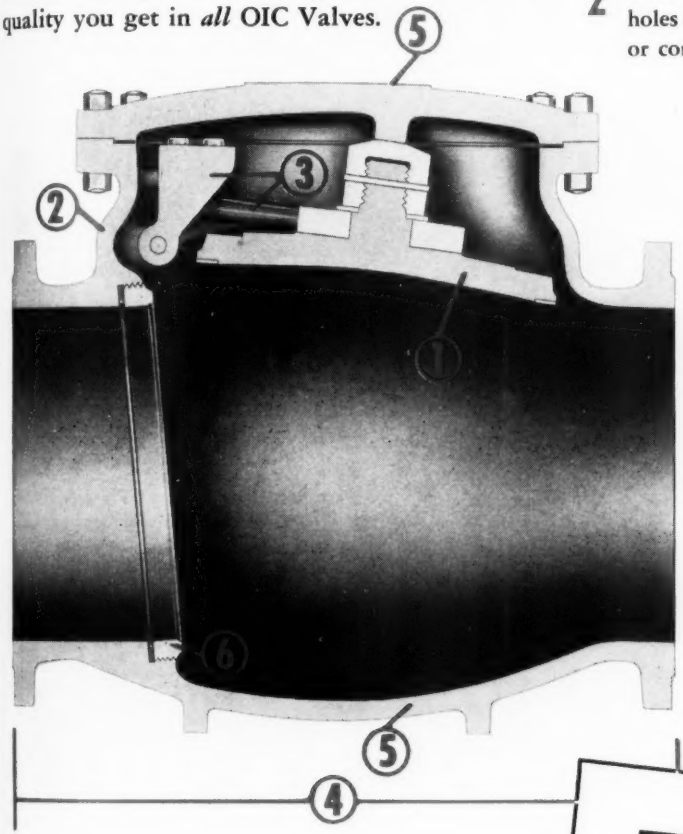
OIC VALVES
CHECK DANGEROUS BACKFLOW IN PIPELINES

SPECIFICALLY designed to check dangerous backflow in pipelines — proved in pipeline service — OIC Full-Flow Cast Steel Swing Check Valves offer you features typical of the extra quality you get in *all* OIC Valves.



1 A Disc which in the wide-open position completely clears the portway — permits free passage of a pipescraper!

2 A Valve Body *without* drilled, tapped or plugged holes through its side. No chance for body leakage or concentration of stress at any point.

3 A Disc Assembly that can be serviced or completely removed through the body-neck. Since there is no hinge pin to remove through the body-wall, installation can be made without regard to side clearance.

4 API face-to-face dimension regardless of size or pressure class.

5 Cast Carbon-Molybdenum Steel Body and Cap in 300-pound and higher pressure series. Cast Carbon Steel in the 150-pound series.

6 A full selection of trims for every service.

Write for Complete Data on OIC Cast Steel Gate and Swing Check Valves for Pipeline Service.

THE OHIO INJECTOR CO.
WADSWORTH, OHIO

OIC
SETS THE PACE IN VALVES

Centrifugally Cast

ACIPCO STAINLESS STEEL

Tubes and Parts

Plain carbon and corrosion- and heat-resisting alloy steel tubes and parts produced to close specifications from steel melted in electrical furnaces under rigid production controls.

An order of Heat-resisting alloy steel Retorts having 28% Chrome—15% Nickel. Butadiene Furnace Tubes with 25% Chrome and 20% Nickel and other stainless steel tubes have also been supplied. All tubes cast in 16-ft. lengths. Diameters from 3½" to 50".

Also manufacturers of Corrosion-resisting Bolts of Alloy Cast Iron and Ni-Resist Iron.

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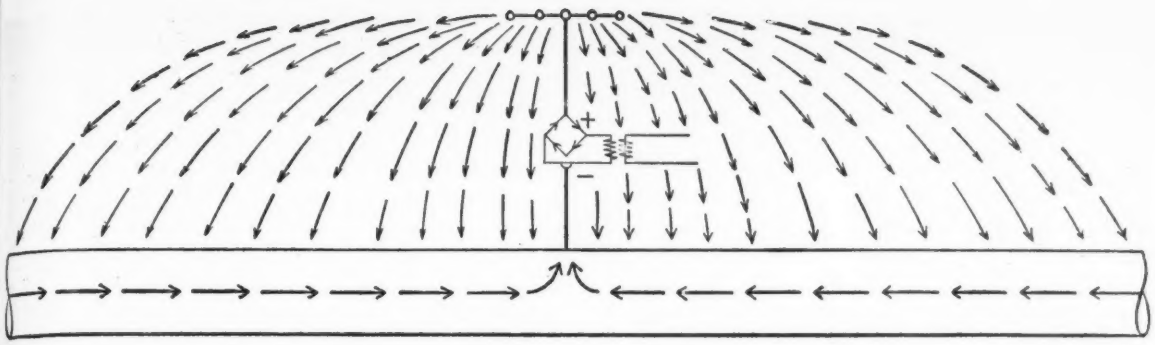
Birmingham 2, Alabama



HIGH RESISTANCE COATINGS

INCREASE THE LIFE EXPECTANCY OF YOUR PIPELINES

Barrett* Coal-tar Enamels, because of their low moisture absorption under varying conditions of the soils, provide a constant, uniform and long-lasting resistance to electrical leakage.

Mechanically applied by modern methods, these coal-tar enamels assure the proper continuity of the insulation.

Electrical inspection improves the quality of application and the handling of pipe during construction and, together with a protective pipe coating of stable dielectric strength, makes cathodic protection economical. This combination permits the use of a minimum number of cathodic protection units, spaced the maximum distance, and a minimum investment in the complementary electrical protection. A dependable procedure when designing corrosion-proof pipelines.

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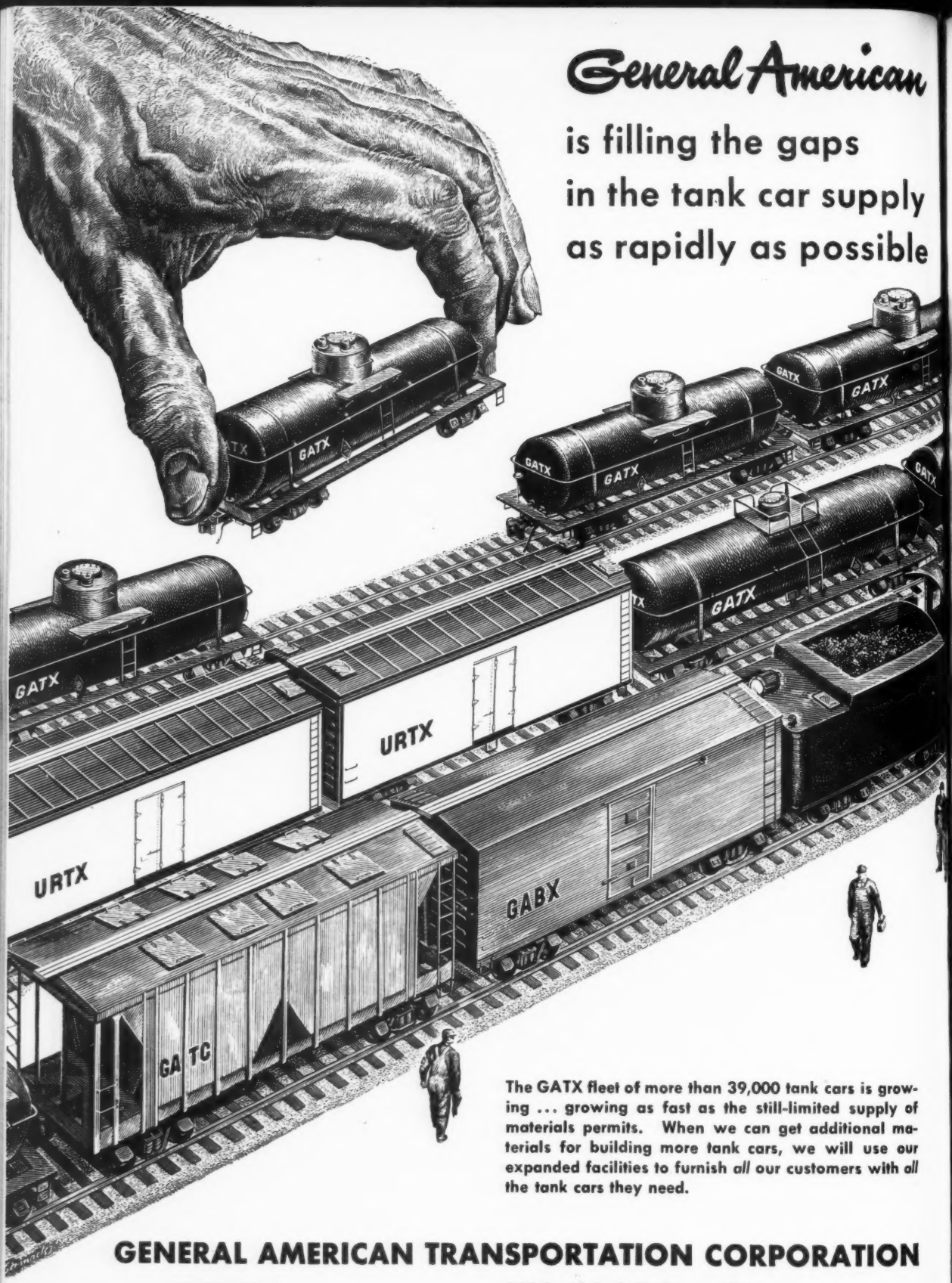

General American

is filling the gaps in the tank car supply as rapidly as possible

The GATX fleet of more than 39,000 tank cars is growing ... growing as fast as the still-limited supply of materials permits. When we can get additional materials for building more tank cars, we will use our expanded facilities to furnish *all* our customers with *all* the tank cars they need.

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THE OIL AND GAS JOURNAL

Pipe-Line Year

PLACED end to end the major pipe-line projects completed over the past year would extend across this country, east to west, approximately two times, and about the same mileage of new lines is being laid at this time. Arteries planned for the near future, in length, are double the total of those completed in recent months and those under way.

Outside this country construction has been delayed, largely because of lack of pipe, but lines now being laid exceed 4,000 miles and plans have been announced for an additional 7,500 miles. These figures and comparisons briefly summarize the crude-oil, product, and natural-gas pipe-line-construction situation as detailed in this issue, which features the engineering, operating, and economic phases of the most active pipe-line year.

In the transmission of liquids the completion of several small and large systems over the past year prevented consumer shortages despite large gains in demands. Crude-oil lines up to 24 in. in diameter are adding to the efficiency of trunk systems connecting the fields of the Southwest to the refining centers of the Middle West and East. The big-inch lines with their specially designed pumping equipment are establishing new standards in operation and when new capacity catches up with demands there will be a general replacement of the 6, 8 and 10-in. lines on which the industry's transportation was founded and expanded for many years.

Time was when the coal, railroads, and allied interests were usually able to prevent the extension of natural-gas transmission except within or adjacent to the producing areas. But higher prices for these competitive fuels, and transportation services and labor difficulties have brought consumer demands for natural gas which federal and state regulatory bodies could not ignore. Outstanding is the amazing expansion in facilities from Texas and Louisiana fields to the Pennsylvania, New York and New England in the past largely dependent on coal; and to California on the west where continued industrial and population growth is dependent on supplementary gas from outside the state.

Some have assumed that when present programs are completed the pipe-line trend of petroleum transportation will have accomplished its main objectives and there will be little left to do. This analysis would not be made by anyone familiar with the increasingly sound economic position of pipe lines in both liquid and gas transmission.

New crude lines will be needed for expanded field and refinery output, including new sources of supply such as the Rocky Mountain areas in this country and Canada. Little more than a start has been made in the possibilities of product transportation in this and other countries. Unless there is unwarranted interference by Government, growth in natural-gas transmission for a prolonged period will continue apace.

Holman Warns N. P. A. Against Price Dislocations in Fuels Competition

by Warren W. Burns

ATLANTIC CITY.—The trend from coal to oil and gas as the chief supplier of the nation's energy cannot continue indefinitely, Eugene Holman, president of Standard Oil Co. (N.J.), declared in addressing the annual meeting of the National Petroleum Association here September 15-17.

He warned that the coming shift will bring new economic conditions to the oil industry and expressed the hope that it will be accomplished by the basic factors of supply, demand, and price. Cautioning against excessive price increases, he said "let us hope that the equilibrium will be reached by sound, orderly progress, rather than through wild swings and stiffening controls."

W. S. Zehrung, president of the Pennzoil Co., was elected president of N.P.A., with the other officers being as follows: Earle M. Craig, Freedom-Valvoline Oil Co., first vice president; and A. W. Scott, Wolf's Head Oil Refining Co., second vice president. Fayette B. Dow was reelected general counsel. Other reelections were Harry S. Elkins as traffic attorney, Horace L. Lohnes, Joseph E. Keller and Donald C. O'Hara, as general attorneys; Herbert G. Eaton as recording secretary; G. B. Hunter as treasurer; and Margaret A. Miller as assistant treasurer.

Approximately 600 oil industry representatives registered at this year's N.P.A. convention.

Sees "New Look" in Oil

The "new look" in the oil industry, Holman told the convention, is not due to any sudden change in consumers' desires but is part of a gradual evolution of the industry. "Today it becomes increasingly clear that people expect us to take a bigger share in the biggest job we have ever had," he said. "We are called upon to supply energy for the growing needs of civilization as a whole."

Reviewing the growing use of petroleum and natural gas at the expense of coal, Holman said "a full realization of the implication of this rapid expansion of the outlets of petroleum shows some pretty basic new concepts of our business are being formed.

"Possibly the first of these is that, at least for some time to come, there is little likelihood of our again having a lot more to sell than our existing customers can readily consume. We are pressed on every hand to meet growing needs for our products. Not until the last few months could we see evidence of working our way out, and this only by breaking record after record in production and supply, and with little prospect for any letdown.

"Here is a new era of thought for us—one in which our conduct will be of great importance. In this striving to expand supplies we cannot be forgetful of the fact that apprehensive and in many cases critical eyes are focused on us. The possibility of our falling short of needs has become a matter of great public concern.

Relationships Changing

"As major contributors to the basic energy supply of the country, we cannot fail to consider the changing relationships between principal energy sources. Plainly, the trend of the last two decades from coal toward oil and gas cannot continue indefinitely, especially since our ultimate resources of coal are much greater than of oil. The increasing penetration of oil into the broad energy field is certain to bring about new price relationships reflecting the competition between energy sources and the available supplies.

"The effect of rising prices in slowing the trend from coal to oil has already been felt. The development of the economic relationships between coal, oil, natural gas and other energy sources—not to forget nuclear fission — lies ahead. It will surely have new and important effects on our business.

"In the change from a situation where supply was greater than current demand to one where potential demand is greater than the readily available supply, we are subjected in many cases to completely new economic conditions.

"There could be a tendency, for example, to take advantage of a short supply situation and let the prices of our raw materials and of our products get into an inflationary spiral. To their credit, it seems to me that great restraint has been displayed by most of the units in the industry.

"Basic economic laws are bound to be the ultimate controlling factors in any situation depending upon relationship between supply and demand. The danger, however, is that of prices

(Continued on page 359)

Sidney A. Swensrud, president of Gulf Oil Corp., left, was one of the principal speakers at National Petroleum Association meeting at Atlantic City. N.P.A.'s newly elected president, right, is W. S. Zehrung, president of Pennzoil Co. In the center is J. B. Fisher, president of Kendall Refining Co., retiring N.P.A. president. Excerpts from Swensrud's speech were published in The Oil and Gas Journal, September 16, page 62

Pacific Coast Strike Negotiations Deadlocked but Supplies Increase

PACIFIC Coast states buckled down for a long seige of short supplies of gasoline this week as it appeared there would be no early settlement of the strike of the Oil Workers International Union (C.I.O.) at the refineries of six major companies in California.

Early this week negotiations were still deadlocked, with the union refusing to accept the companies' offer of an increase of 12½ cents per hour, the same offer that existed at the start of the strike at midnight, September 3.

Refineries on the Coast still operating have increased their production of motor fuel, and tank car shipments from Texas and the Mid-Continent are reaching some of the western states. One tanker load of gasoline is on its way to California from the Gulf Coast.

As a result of this and curtailment of use, the supply situation is improving. The quantity of gasoline now on hand in Southern California has increased from 5 days' supply as of last week to 15 days' supply, which indicates that the industry is more than able to provide the supplies necessary under the allocation program.

In the Northwest, supply has increased from 14 days' supply of gasoline to 17 days' supply. Northern California supplies have remained constant, with 8 days' supply still available. Within the past few days crude runs at operating refineries have increased from 50 per cent of the prestrike figure to two-thirds of normal volume.

Management Is Firm

Although the Federal Conciliation Service was attempting to find a basis for settlement of the strike, an indication that management is firm in its position may be seen in the following statement given to The Oil and Gas Journal by Reese H. Taylor, president of Union Oil Co. of California:

"In offering 12½ cents, it was recognized that there has been an increase in the cost of living since present wages were established January 1, 1948. Latest available Department of Labor figures show that the cost of living has gone up 72 per cent since 1941. The offer that was made, amounting to $1.00 a day, would have raised wages 83 per cent above the 1941 level. And it would have brought the total of wage increases to our refinery employes since the end of the war to 65.3 cents per hour—or an increase of $5.22 per day.

"The demands of the union representatives were so far out of line with the cost of living index we simply couldn't take the responsibility of considering them. It is a well-established fact that any major change in the 'wage negotiation base' of one industry is inevitably followed by similar changes in other industries. Therefore, if we had accepted the O.W.I.U. - C.I.O. requests — assuming that it was economically possible to do so, which it certainly wouldn't have been under our present price structure (as a matter of fact, it is highly doubtful if any wage increase is possible without an increase in prices), we would be abandoning the 'wage negotiation base.' This is pretty generally accepted all over the country. Then we would have been responsible, in all probability, for setting off a chain reaction of wage increases all over the country."

Allocation Plan Working

In Washington, Max W. Ball, director of the Oil and Gas Division, said Tuesday that if "nothing further goes wrong" essential users in the West can count on getting gasoline indefinitely and nonessential users on about the present basis for 30 days, despite the refinery workers' strike.

Ball said that the above prospect did not take into account the fact that Union Oil Co. resumed operations Thursday of last week and The Texas Co. on Sunday.

"This doesn't mean that when the strike is over the public can get all the gasoline it needs," said Ball, who has just returned from the Coast. "It will take months to catch up."

Under the voluntary allocations plan worked out to meet the shortage caused by the strike, filling stations are getting supplies on basis of 75 per cent of their July deliveries. They agree to supply all needs of commercially-licensed cars, doctors, nurses, the military, food handlers and distributors and certain others. After these are taken care of, nonessential car users may be supplied, and this is usually on a first-come first-served basis, Ball explained.

"The thing seems to be working, and most satisfactorily. There are almost no squawks and the public is cooperating," Ball said. Independents, although harvesting the business with the majors struck, agreed to the plan virtually unanimously. Pleasure car operation, he added, is below normal.

He also said that outlook was that West Coast refiners, for the duration of the strike, would concentrate on a single grade of gasoline as recommended by the regional advisory committee. One or two independents, however, will continue to make premium gasoline where their output would not be increased by dropping it.

Ball said that while everybody on the West Coast currently is talking gasoline since the strike, if the walkout lasts much longer there will be a shortage of heating oils and diesel fuel next winter. Even if the strike "should end tomorrow" there still will be a tight situation on the distillates next winter, Ball said.

Ball Says Refiners Must Raise Distillate Yields

WASHINGTON.—The refining industry must turn attention immediately to maximizing yields of distillate heating oils and diesel fuel if winter demands are to be met, Max W. Ball, director of the Oil and Gas Division, said in announcing that this matter will be taken up at once with regional committees under the voluntary allocation plan.

Ball reported that he had written to the governors of the 33 Eastern states urging them to appoint or reappoint promptly their oil coordinators under the voluntary program. This was done, Ball explained, so that all the machinery will be set up so that if any oil supply difficulties develop this fall "we can deal with them promptly."

In a memorandum to all concerned with the allocation plan, Ball suggested that this plan be officially styled "voluntary petroleum products allocation plan under public law 395."

Basing-Point Price Law Predicted by Senator

WASHINGTON. — Legislation validating pricing systems under which individual companies absorb the freight charges incurred in getting their products to their customers is expected to be sought of Congress next year as a result of an investigation of the effects of the Supreme Court decision in the cement case now being made by a special Senate committee.

Under the court decision, as interpreted by many lawyers, any pricing system including systematic freight absorption is illegal if the Federal Trade Commission or the court concludes there is a "reasonable possibility" of injury to competition. This appears to be true even if a concern should systematically absorb freight, in an industry where freight was substantial, as a means of meeting the prices of a competitor located closer to the customer, even in the absence of a conspiracy or agreement among the sellers.

Southwest's Crude Oil Shortage Easing As Supply Improves

by Dahl M. Duff
District Editor, Houston

IMPROVEMENT in products supply and signs that the shortage era is ending appears to be easing slightly the extremely tight market in crude oil in the Southwest.

Some purchasing officials contend the effect thus far is psychological. Actually, they say, crude oil is as hard as ever to find but that buyers and producers alike are now beginning to wonder how long the situation will continue.

There is certainly no present excess of crude oil in the Southwest. Texas and other producing states are continuing with outputs generally at maximum efficient rates, and refinery runs remain at near capacity levels.

Indications that the crude-oil market is loosening up are few and scattered. First to be affected are the premium payments which became fairly widespread despite a series of increases in the posted price since the war.

Reports in Houston are that one or two small buyers have discontinued higher premiums in the last few weeks and that some producers now seem more anxious for a contract of 6 months' or a year's duration with the existing premium, rather than for an increase in the premium itself. One relatively small purchaser on the Lower Gulf Coast is said to have notified producers of some of its crude it would no longer be able to pay a 25-cent bonus.

Fewer Premiums

The larger companies with some few exceptions have turned down requests for premiums above the posted price for crude oil. As another possible sign of an easing market, one major purchaser mentioned his office formerly had received frequent letters from producers reporting they had been offered premiums and asking if the company planned to meet them. For the last month or so, he said, not a single letter of this nature has been received.

Oil-company officials in the Gulf Coast area have varying opinions on just how much the crude-oil supply has improved. Most of them agree there is not quite the same frantic pressure on the market and the bidding for connections as prevailed earlier this summer.

However, they emphasize that it will undoubtedly be a long time before any general improvement in crude supply will be apparent. Normally a buildup in products stocks would continue to the point where runs were affected, thus throwing crude back on the market. This is not at all imminent, these officials say, since the industry is operating on too close a margin between supply and demand. Stock figures, including those of crude oil, can be misleading in that an increasingly greater amount of oil is being used as operating or working stocks. The requirements for this type of stocks have increased greatly in recent years due to the expansion of such industry's facilities as pipe lines and refineries.

Despite some slight easing of the crude market, premium payments are still being widely paid. Reports are that about 5 per cent of the total crude produced in Texas, South Louisiana, and New Mexico is moving at above-posted prices. Premium crude oil is said to amount to about 170,000 bb. daily in this area, and to have shown an increase of approximately 15,000 bbl. daily during the summer.

"Deals" Still Common

The average premium has been calculated to be 14 cents. In addition to outright bonuses in money, various other inducements are still fairly common to crude-oil producers. These include pipe, assistance in financing drilling, and term contracts for the purchase of production.

It has been estimated that something over 200,000 bbl. daily of additional oil—new production or imports—would be required to end the premium market completely. This, of course, assumes a static demand for products.

Members of the Texas Railroad Commission are known to be watching the market demand situation with interest. They are prohibited from considering price in fixing allowables, but there have been some indications that the present rate of production in Texas may be contrary to conservation and maximum ultimate production in some fields.

Next Oil Exposition To Be Held in 1952

The next International Petroleum Exposition will be held in 1952. Exact dates have not yet been determined.

Decision to hold the event in 1952 was reached by both the executive committee of the I.P.E. and the Petroleum Equipment Suppliers Association. It followed a survey which showed that 78 per cent of the 1948 exhibitors favored that year as the choice for the next oil show.

An announcement by W. G. Skelly, executive committee chairman; W. B. Way, I.P.E. manager; and W. M. Bovaird, vice president of P.E.S.A., said exact dates will be announced soon.

Natural Gas Tax to Be Texas Political Issue

HOUSTON.—Oil-company officials here appeared to be somewhat surprised over last week's action of the Texas Democratic Party in endorsing a tax on natural-gas production.

The recommendation was included in the party's 1948 platform which was adopted by the party's convention in Fort Worth. The platform asked a "reasonable tax" on natural-gas production to finance rural-road construction and said that other sources of revenue for this purpose also should be considered.

As far as was known, the action of the convention in Fort Worth marked the first time the state's dominant political party has gone on record for such a tax. Such an endorsement apparently had not been anticipated.

The gas-tax plank in the party's platform made certain another fight over the issue in the Fifty-First Texas Legislature which convenes January 12 in Austin. The question has risen periodically in Texas politics.

There has been renewed discussion of the likelihood of passage of a natural-gas tax in Texas since the Louisiana Legislature last spring doubled its gas gathering tax to 1 cent per 1,000 cu. ft. It is reported an effort also will be made in the legislature to raise Texas' present severance taxes on crude oil, now 4⅛ per cent of value. Besides increasing the gas gathering tax, the Louisiana Legislature raised oil severance taxes to double and triple their previous rates.

NPC To Meet October 21

WASHINGTON.—National Petroleum Council Chairman Walter S. Hallanan announced formally last week that the next quarterly meeting of the council will be held October 21. Tentatively, the date had been set as October 14 but the meeting was postponed because it would conflict with other oil meetings previously set for around the same date.

Max W. Ball, director of the Oil and Gas Division, will remain on his job, from which he has been trying to retire for months, until after the council meeting.

_____this week

SUPPLY—Pacific Coast refinery strike cutting into reserve stocks of other areas. . . . Could have nation-wide effect if long continued. . . . But western states have adequate motor fuel for essential needs. . . . Allocation plan working well. . . . ¶Oil and Gas Division asks refiners to maximize distillate yields. . . . ¶Crude-oil shortage easing in Southwest but premium paying has not disappeared. . . . ¶Reduced allowables cause drop in Texas crude production. . . .

GOVERNMENT—New procedure designed to keep Marshall plan from cutting deeply into domestic oil supplies. . . . ¶Exports of residual fuel permitted now against fourth-quarter quotas. . . . ¶Navy plans more drilling on reserves in Alaska and California. . . . ¶Tax on production of natural gas promises to be political issue in Texas. . . .

MEETINGS—Eugene Holman warns National Petroleum Association against excessive price increases as means of shifting trend away from oil and back to coal as primary energy source. . . . Says industry's size and importance requires attention to public opinion. . . . ¶Corrosion engineers discuss new methods of combating corrosion in oil wells, pipe lines, and refineries. . . . ¶Drilling contractor, mining engineer, and mechanical engineer groups announce meeting programs. . . .

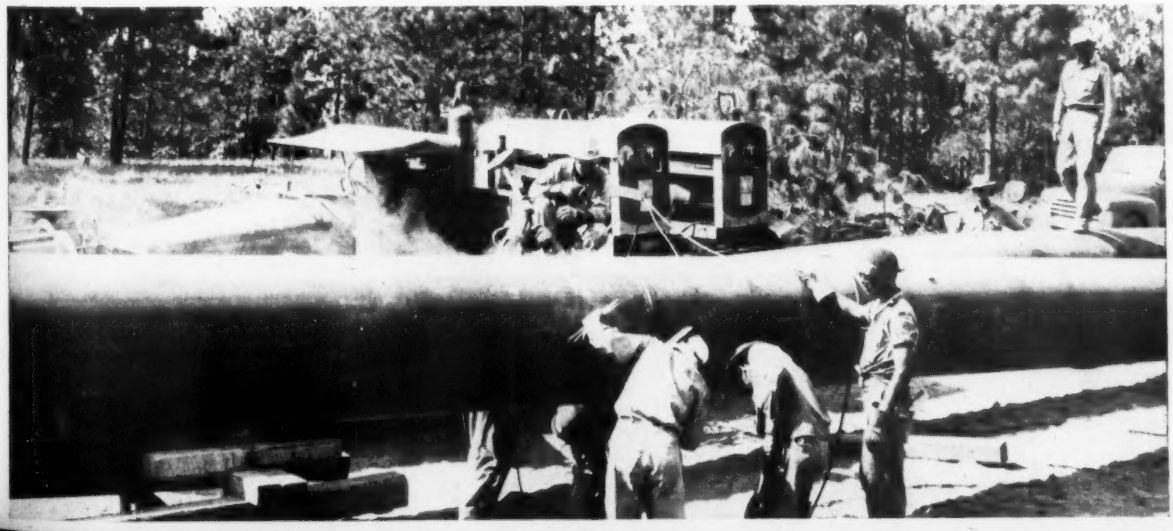
PIPE LINES—Federal Power Commission approves looping El Paso line to take additional 100,000,000 cu. ft. daily of Texas gas to California. . . . Company will start several spreads of the new project before end of this year. . . . ¶Texas Pipe Line Co. awards contract for crude-oil feeder line in Archer County, Texas, to join Jal-Cushing line. . . .

INTERNATIONAL—Province of Alberta, Canada, now the focus of industry eyes. . . . Lease play in northern part brings 5,000,000 acres under reservation in single week. . . . Discoveries reported, some unconfirmed, at Redwater, Pincher Creek, South Leduc, North Turner Valley, and Peace River. . . . ¶Venezuelan crude production again sets new record. . . . Natural-gas statistics reported for first time. . . . ¶Y.P.F. working on extensive program to increase Argentine crude production and refining capacity. . . .

REFINING—Total operating capacity of United States refineries now exceeds 6,000,000 bbl. daily, Bureau of Mines survey shows. . . . Cracking capacity also up. . . . Due both to new construction and increased efficiency. . . . ¶Sun Oil Co. lets contract to double capacity of its Toledo refinery. . . . ¶Standard of Indiana contracts to sell refinery gas at Whiting to Carbide & Carbon Chemicals Corp. as raw material for chemicals production. . . .

TRENDS—Well completions increased during week ended September 18, reaching total of 802. . . . Compares with 766 previous week and 733 corresponding week of 1947. . . . ¶National production and refinery statistics incomplete because of California strike, but refineries on Texas Gulf Coast set new high record with runs of 1,512,000 bbl. daily week ended September 11. . . . ¶East of California distillate stocks reached all-time high of 57,355,000 bbl. September 11, compared with 55,019,000 week previous. . . . High point in 1947 was 48,706,000 bbl. end of October, and in 1946 it was 55,667,000 bbl. end of November. . . . ¶Kerosine stocks increased 650,000 bbl. and residual fuel 1,778,000 bbl. during the week. . . . Gasoline stocks dropped slightly but total stocks of the four major products increased by 4,264,000 bbl. . . .

This week The Oil and Gas Journal presents its annual Pipe Line Number, with a special section beginning on page 165 and an inserted wall map showing crude-oil and products pipe lines of the United States. The picture below shows welding a stringer bead with an electrically driven internal line-up clamp. It is a section of the 30 and 31-in., 210-mile loop of Tennessee Gas Transmission Co. being laid near Jasper, Tex., by H. C. Price Co. and Bechtel Corp.



N. A. C. E. Regional Group Reports Methods of Combating Corrosion

by R. B. Tuttle and Paul Reed

TECHNICAL sessions of the South Central Regional Meeting of the National Association of Corrosion Engineers, held in Tulsa, September 20-21, were largely concerned with problems connected with oil production refining and pipe lines.

During the sessions and in between them there was considerable discussion of current applications of inhibitors for mitigating corrosion in oil and gas wells, as well as condensate wells, and even regarding their future possibilities for tankage in sour-crude areas. The significance of sacrificial anodes for cathodic protection of pipe lines attracted attention because of recent studies of magnesium-type installations.

The frequent absence of galvanic corrosion in oil and gas wells, where it might casually be anticipated, led F. L. Laque, International Nickel Co., to deal comprehensively with factors that influence incidence and extent of galvanic action. He pointed out that tubing made of alloy steel or even a material as noble as stainless steel or Monel could be placed inside steel casing, without introducing any risk of significant accelerated corrosion of the latter, for two reasons: (1) The electrolyte between tubing and casing would be substantially free from oxygen and the galvanic cell would be stifled quickly by cathodic polarization; (2) the area of the more noble tubing material would be less than that of the casing so that at the worst the galvanic corrosion of the casing would be limited to something less than twice its normal rate of corrosion, which usually would be tolerable. In oil wells equipped in the usual way, severe galvanic effects could be effectively reduced by inhibitors.

Condensate Wells Studied

In considering control of corrosion in condensate wells, D. T. Mac Roberts, United Gas Pipe Line Co., directed attention to the numerous phenomena calling for explanation. Environment which appears corrosive does not necessarily mean that corrosion actually occurs. Possibly a naturally developed inhibitor may be formed in certain wells. Of the three types of inhibitors being applied by operators to mitigate corrosion in condensate wells, sodium bicarbonate lacks most of the disadvantages possessed by the others. Alloyed tubing is effective but costly. Nickel-coated and baked resins may have breaks in coating which would accelerate corrosion. Polar compounds have possibilities for future development for inhibitor use. About 75 per cent of condensate wells can be sufficiently inhibited to avoid corrosion.

Walter F. Rogers, Gulf Oil Corp., mentioned, in the discussion of Mac Roberts' subject, that in wells with tubing set with packer, a successful practice had been applied by injecting sodium bicarbonate and keeping the wells closed for 30 minutes, before putting the well back on production. Such treatment every 24 hours was satisfactory in all cases observed except one well where injection was required every 12 hours.

A symposium on the internal protection of sour storage tanks was conducted by R. L. Bullock, Interstate Oil Pipe Line Co., in a panel discussion carried on with A. T. Clothier and F. T. Gardner, Carter Oil Co., Sam T. Schultz, Natasco Co., and H. D. Murray, Texas Co. Results observed on the recent West Texas N.A.C.E. inspection trip were analyzed. This trip was sponsored by the Midland and Odessa sections of N.A.C.E.

Cone-shaped sumps in tank bottoms noticeably contributed to reducing tank corrosion. Aluminum roofs have demonstrated their value. The effectiveness of tank coatings has been improved by cleaning and sand blasting before application.

Technical factors in testing pipeline coatings were dealt with by M. W. Belson of D. E. Stearns Co.

The paper "Crude Still Overhead System Corrosion" presented by A. F. Blumer, Esso Standard Oil Co., described the corrosion problems encountered in operations of his company's Baton Rouge,, La., refinery. Experience over a number of years show that Monel linings in general corrosive areas in the overhead system of the two-stage crude-oil distillation units is satisfactory. Copper alloy tubing in exchangers and condensers is subjected to a special form of corrosion, according to Blumer. Failures in tubes in these areas are due principally to conditions of so-called stress-corrosion. Blumer classified stress-corrosion into two types,

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Officers of National Association of Corrosion Engineers' organizations who participated in South Central Regional Meeting: (Standing) Thomas F. P. Kelly of James E. Mavor organization, secretary-treasurer, N.A.C.E. South Central Region; R. L. Bullock, Interstate Oil Pipe Line Co., chairman, Tulsa Section; Nathan Schofer, Cities Service Refining Corp., vice chairman of South Central Region and chairman of program committee; Tom R. Statham, Magnolia Pipe Line Co., assistant secretary-treasurer, South Central Region; J. C. Stirling, Stanolind Pipe Line Co., chairman local arrangements committee. (Seated) L. F. Scherer, Texas Pipe Line Co., director, South Central Region; F. L. Laque, International Nickel Co., Inc., president of N.A.C.E.; Don Good, Texas Pipe Line Co., chairman South Central Region; Derk Holsteyn, Shell Oil Co., Inc., chairman general arrangements South Central Region

Marshall-Plan Allocations Not to Cause Undue U. S. Drain, ECA Says

WASHINGTON.—Economic Cooperation Administration officials gave assurance this week that the new procedure of allocating funds to Marshall-plan countries for purchase of oil and other commodities on a quarterly basis will not be permitted to result in undue drain on supplies from any area.

Authorizations for oil and products will continue to be limited to the availability of supply, and the American companies have been asked to furnish the ECA with quarterly estimates of what they will have available for shipment under the European recovery program.

Under the new procedure, the ECA no longer will pass on individual commitments in advance but will make allocations to the several countries on a quarterly basis, showing the over-all amount which may be expended for the procurement of petroleum but leaving to the individual country the determination of the products it will require. Each country will be advised, however, of the area from which it shall draw its supplies —United States, Caribbean, or Middle East.

Price Check Needed

While the new system will relieve the ECA of much paper work and permit the Marshall-plan countries to lay out long-range procurement programs, it also will require an even closer check on prices. A main objective of ECA is to insure that the recovery program does not contribute to the raising of prices, and it has set up safeguards against the payment of premiums, bonuses, or above-market prices.

ECA officials anticipate that the 1-year programs worked out by the Marshall-plan countries at the recent Paris meeting of the Organization for European Economic Cooperation and shortly to be submitted to Washington, will include funds for petroleum equipment. No definite figures ever have been developed as to what would be required in this field beyond the initial estimate of the Committee for European Economic Cooperation that a total of $1,900,000,000 would be required over the 4 years of the program, of which $583,000,000 would be financed by the United States and the remainder by the European countries themselves, not including the expenditures which would be made by the American oil companies operating abroad.

These estimates, however, never were taken seriously by the United States committees which reviewed the CEEC figures, it being pointed out that they were beyond the capacity of the equipment industry to produce and were based on ambitious programs for conversion from a coal to an oil economy which Europe could not attain under any circumstances.

In all probability, the necessary export licenses will be sought of the Department of Commerce before the ECA is asked to approve equipment purchases. ECA is holding to the export quotas as set up by the department, and there are no indications that it will attempt to influence Commerce officials to set up larger quotas than they believe proper. If Commerce is prepared to grant licenses, however, ECA will go ahead and approve purchase programs.

One of the objectives of the program is to expand European refinery capacity. So far, the only country to make definite progress is France, where existing facilities have been revamped and output changed to produce more of the products most essentially required.

Master Plans Hearings For Tidelands Dispute

WASHINGTON. — Department of Justice and California officials will confer with Justice D. Lawrence Groner, special master in the California tidelands case, September 27, to plan the inquiry which he is to make on the conflicting claims of the state and federal governments to the offshore oil fields to which the Supreme Court last year held the United States had paramount rights.

The special master has the authority to summon witnesses and take evidence on which to base the report and recommendations he is to make to the court, and it is expected that hearings will be held in California, where state officials are anxious that Groner make a personal survey of the lands involved.

The Supreme Court appointed the special master at the urging of California, to determine the exact boundary lines between state and federal juridiction in three areas to which the federal Government laid claim.

Crude Imports Drop While Exports Rise in July

WASHINGTON.—Export of crude petroleum increased to 3,661,000 bbl. valued at $10,800,000 in July from 3,419,000 bbl. valued at $10,400,000 in June, but failed to equal the July 1947 export of 5,184,000 bbl. valued at $11,000,000, it was reported last week by the Department of Commerce.

Imports of crude amounted to 10,804,000 bbl. valued at $23,200,000, compared with 11,427,000 bbl. valued at $24,900,000 in June and 8,033,000 bbl. valued at $13,400,000 in July a year ago.

The department reported that product exports included 3,319,000 bbl. of gas and fuel oil valued at $11,200,000 in July, against 2,614,000 bbl. valued at $9,500,000 in June and 3,587,000 bbl. valued at $8,800,000 in July, 1947; 1,134,000 bbl. of lubricating oil valued at $18,000,000, against 1,290,000 bbl. valued at $19,300,000 in June and 1,300,000 bbl. valued at $18,800,000 in July 1947, and 3,171,000 bbl. of gasoline valued at $15,700,000 against 2,620,000 bbl. valued at $13,000,000 in the preceding month and 3,400,000 bbl. valued at $12,900,000 in the corresponding month last year.

Imports included 4,348,000 bbl. of gas and fuel oil valued at $8,900,000 against 4,315,000 bbl. valued at $9,600,000 in June and 4,625,000 bbl. valued at $6,700,000 in July a year ago.

Marshland Operators Seek Freedom From ICC Rules

WASHINGTON. — The Interstate Commerce Commission last week took under consideration a petition filed last April 20 by the American Waterways Operators, Inc., for extension of the marshland oil fields of Alabama, Florida, and Mississippi of the exemption from ICC regulations granted in 1941 to contract carriers in Louisiana and Texas.

The exemption covers contract carriers by water engaged in the leasing or chartering of vessels for the purpose of transporting machinery, materials, supplies, and equipment incidental to, or used in, the construction; development, operation, and maintenance of facilities for discovery, development, and production of oil and natural gas.

American Waterways Operators contended that the situation with respect to transportation in the states sought to be added to the exempt territory is the same as that in the marshland oil fields of Louisiana and Texas. The petition was supported by letters from six oil companies and nine water carriers in the territory.

Michigan Company Buys Three Leases in Texas

McClanahan Oil Co. has purchased three leases containing 15 producing wells in Luling field, Caldwell County, Texas.

The move gives the company its first production in Texas, according to Charles S. Hall, president. The company previously operated only in Michigan.

International

WORLD-WIDE OIL DEVELOPMENTS

Lease Play in Northern Alberta Highlights Canadian Oil Activity

by Charles J. Deegan

IN practically one jump, the exploration play in the province of Alberta, Canada, took an on increase of about 16 per cent in acreage under reservation, and moved out boldly into the northern and sparsely settled portion of the province. Over 5 million acres of crown reservation oil and gas rights were taken by independents and majors in practically 1 week. This more than doubled the amount of acreage under reservation in northern Alberta, bringing the total to around 9 million acres. In southern Alberta there were already about 25 million acres under reservation. Thus, for all of Alberta, the jump was from about 29 to 34 million; but for northern Alberta it was a jump of from around 4 to about 9 million acres.

Independents Active

The most sensational feature of this jump, however, was the daring and imaginative scope of a 4-million-acre play made by a group of Canadian independents, who may have still other backers not yet announced. Starting around the town of Athabaska, this play extends northeast and north along the railroad to Waterways, thence with a tip extending northward along the river almost to Mackay; and from Waterways southwest and south along the river back to Athabaska; forming a rough oval of continuous acreage. (See map.)

This acreage takes in just about everything between Athabaska and Mackay that is accessible by railroad, waterway, or road. Then jumping out northwest of Athabaska along the railroad, the same group picked up a block of around 500,000 acres along the south side of Lesser Slave Lake. One other semiisolated block of roughly 250,000 acres was taken by the group. This block lies east of Mistahae Lake, and includes part of both North and South Wabiskaw lakes. (See map.)

Twenty subsidiary companies were formed by the group, each company taking its limit of 200,000 acres of oil and gas prospecting rights on crown reservations. Dr. T. A. (Ted) Link will direct the geological exploration, while Herbert Hoover, Jr., and United Geophysical Co. of California will have charge of geophysical operations. Dr. Link, internationally known geologist, only recently resigned as chief geologist for Imperial Oil Co., Ltd., after 29 years' service with that company and its affiliates.

George McMahon and A. P. Bowsher have been announced as president and secretary-treasurer respectively of each of the 20 subsidiary companies. Each is also a director. The other two directors in each case are L. M. Yodell and Wilder Ripley. McMahon, Bowsher, and Yodell are associated with Pacific Petroleums, Ltd., or its affiliates, an active independent producer, while Ripley is associated with Tower Petroleums, an active independent exploration company. It is reported that Pacific Petroleums, Ltd., may be used as the operating unit.

The size of the project lends support to rumors that large financial support will be given by American oil groups, as yet unannounced. Two gravity-meter crews are reported ready for reconnaissance work immediately, and United States geophysical circles believe three more gravity crews are being organized by United for movement to Canada in the near future. Some geophysicists estimate that it will take about five gravity-crew years to high-grade 4 million acres. These crews will be followed by seismograph parties to detail promising areas indicated by gravity reconnaissance, and drilling rigs would then follow up on the hot seismograph prospects.

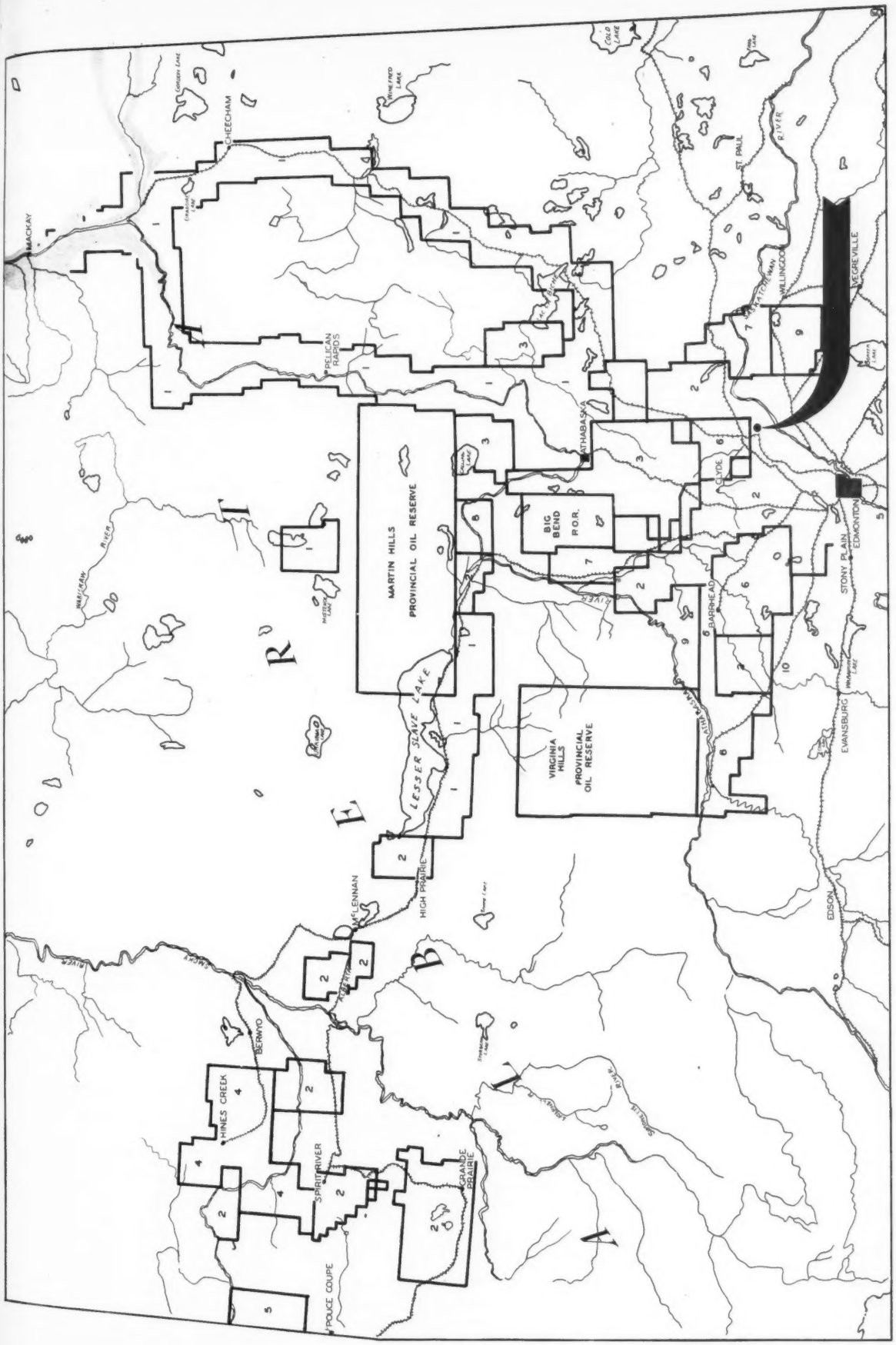
Imperial Oil Co., Ltd., and companies believed to be affiliates, added about three-quarters of a million acres of crown reservation, mostly north and northwest of Athabaska, along the railroad and stretching practically to the British Columbia border on the west. Stanolind Oil & Gas Co., through two subsidiaries, has taken up about 400,000 acres, which fit closely around the edges of the southern end of the oval-shaped block of the independent group first mentioned. The Stanolind acreage lies north, south, west, and northeast of the town of Athabaska.

Wildcat Gets Good Show

Interest in this area has been greatly intensified, as almost simultaneously with the announcement of the new reservations, Imperial 1 Redwater, SE SE 32-57-21w4th, a wildcat, got a good showing in the Devonian lime on a drill-stem test. This well is about midway between Leduc field and the town of Athabaska. If it proves a field, it halves the gap between the presently producing areas and the south end of the new play that begins around Athabaska.

Imperial denied reports that the Redwater test made a large flow of oil on drill-stem test, but did admit encouraging showings. However, the test was good enough for Imperial

Some of the acreage taken up in great northern Alberta exploration play. Arrow points to new Redwater discovery of Imperial Oil Co., Ltd. Leduc field lies off map, just south of Edmonton. Shaded area around Mackay and Waterways area represents famous Athabaska oil sands. Acreage ownership: (1) Concessions of new group of independents; (2) Imperial and subsidiaries; (3) Stanolind Oil & Gas Co., and subsidiaries; (4) British-American Oil Co.; (5) George Maxwell Bell; (6) Gulf Oil Corp.; (7) Barnsdall Oil-Honolulu Oil Co.; (8) Pacific Petroleum, Atlantic Oils (independent Canadian company), et al; (9) Amerada Petroleum Corp.; (10) Texas Co. and subsidiaries. (Acreage locations courtesy Daily Oil Bulletin, Calgary)


MACKAY
CHEECHAM
PELICAN RAPIDS
ATHABASKA
CLYDE
WILLINGDON
GRANDVILLE
ST. PAUL
RIVER
MARTIN HILLS
PROVINCIAL OIL RESERVE
BIG BEND
P.O.R.
VIRGINIA HILLS
PROVINCIAL
OIL RESERVE
LESSER SLAVE LAKE
McLENNAN
HIGH PRAIRIE
BARRHEAD
STONY PLAIN
EDMONTON
EVANSBURG
EDSON
BERWYO
HINES CREEK
SPIRIT RIVER
GRANDE PRAIRIE
POUCE COUPE
ALBERTA
BRITISH

immediately to run a string of casing and cement it. Production tests will be watched very closely. The Redwater is reported to have gotten oil in the Devonian at 3,111-31 ft., and late reports indicate it is coring around 3,160 ft. The Devonian pay at Leduc runs around 5,400 ft. The difference in depth is mainly due to the fact that the Redwater test is located farther updip in the Alberta trough, which pinches out against the Canadian pre-Cambrian surface granite to the east and northeast. Therefore in those directions from Leduc, the Devonian will be found generally at constantly shallower depths.

Amerada Petroleum Corp. holds 100,000 acres of crown reservation lands, beginning not far east of the Imperial Redwater test. It also holds other tracts northeast and east of Edmonton. In its exploration work toward evaluating these concessions, Amerada has inaugurated a slim-hole drilling program of stratigraphic tests, one to a township, spaced about 6 miles apart. These holes are presumably drilled to a Paleozoic geological marker, which would usually be Devonian.

Two Tests Finished

Beginning about June 1 on this program, in the first 3 months with four rigs running, Amerada has averaged about 10,000 ft. of hole per month, or the equivalent of about four 2,500-ft. "strat" tests per month. Two of these were completed in the St. Michel area (the 100,000-acre reservation near the Redwater test) with a third still drilling. One of these was completed on August 20 at 2,825 ft., in NW NW 21-57-19w. This strat test lies 12½ miles east and 1½ miles south of the Redwater.

At the end of the first 3 months of this program, Amerada had completed 10 holes, averaging 2,524 ft., but at depths ranging from 2,058 to 3,425 ft. The average time from spudding to completion was about 24 days, but two of the tests were drilled in 7 days, two in 8 days, one in 15 days, one in 18 days, one in 26 days, one in 31 days, one in 55 days, and one took 63 days. The four rigs are still running. Only 2 of the 10 completed tests were in Amerada's block nearest the Redwater strike, the other 8 being in the blocks farther east.

In connection with the 4-million-acre play of the independents, it is inevitable that there will be speculation about the Athabaska oil sands. The crown reservations of the independent group at the north end of the oval (of which the town of Athabaska is about the south end) logically follow the railroad to Waterways, and then follow the Athabaska River east and south. In so doing, they incidentally cover portions of the south end of the oil sands. But (see map) there is a tip of the reservation which runs straight north up the Athabaska River from the north end of the oval shape proper. This tip covers a large area of the oil sands.

As long as there are oil men and geologists, the Athabaska oil sands will remain a challenge, until all the answers are found. Here in Lower Cretaceous sands, lying unconformably on top of the Devonian limestone, is an accumulation of oil or "near oil" that simply dwarfs anything else in the world of oil. Sober, reliable estimates of a conservative 100 billion (not million) barrels to an optimistic 500 billion (not million) barrels are on record. They stagger the imagination, even though commercially the oil is not yet available.

The recent finding of Cretaceous oil in wells at Leduc, and the development of Lloydminster field in the Cretaceous, along the Saskatchewan-Alberta border, even though 250 or more miles away from the Athabaska oil sands, is bound to revive speculation. There are probably as many variations of theories about the origin and source of the oil or near oil in these sands as there are geologists and oil men familiar with the area. The next 2 or 3 years may reveal whether the independent group and Dr. Link, their geological director, have any ideas they intend to test.

What are the chances that somewhere in the vicinity of these Athabaska sands an oil field will be found that will dwarf anything else in the world? As of today, the best common guess would probably be that there is only a remote possibility of finding anything that big. But most geologists would also probably hedge that although very unlikely, it is not impossible.

Richmond Plans Expansion Of Venezuelan Activities

A "large program of commercial development" of Richmond Exploration Co.'s Venezuelan holdings has just begun, according to Standard Oil Co. of California, the parent organization.

The initial step in this operation will be to transport crude to tidewater on Lake Maracaibo, a step which it is hoped will be completed by the end of this year. An 18-in. 25-mile pipe line is now under construction from Richmond's Boscan field to the lake. Boscan crude is heavy and will be used to manufacture fuel oils and asphalts.

Richmond Exploration has completed its selection of areas for investigation and development from the exploratory concessions obtained in 1944. Approximately 886,000 acres were chosen on the west side of Lake Maracaibo and 421,000 acres in the Orinoco River delta region.

Y.P.F. Purchases Three Seismic Reflection Units

IN an attempt to increase oil production in Argentina, the government oil monopoly, Y.P.F., has purchased three seismic reflection units in the United States and will utilize them initially in the areas of Nuequen and Santa Cruz.

Exploration in the Argentine portion of Tierra del Fuego has also been decided upon, and a wildcat is scheduled to be started soon about 12 miles from Rio Grande on a location selected after a geological and geophysical survey of the area.

Contracts for three refinery projects have recently been signed by Y.P.F. M. W. Kellogg-Pan American Corp. will construct a 30,000-bbl. refinery to include a combined catalytic cracking, alkylation, polymerization, coke, and asphalt unit, and designed to produce 75 octane motor fuel and 120 octane aviation gasoline.

The same company has a contract to construct a combined unit of 18,000 bbl. capacity at the San Lorenzo refinery and one of 9,000 bbl. capacity as a part of the Lujan de Cuyo refinery. These units will include catalytic cracking designed to produce motor fuel of 75 octane. The Lujan de Cuyo refinery will also be equipped to produce liquefied petroleum gas which will be delivered to Direction General del Gas del Estado for distribution to homes in the Mendoza area.

Catalytic Construction Co. has a contract with Y.P.F. to erect a topping plant of 30,000 bbl. capacity at the La Plata refinery to handle sour crudes from Venezuela.

Argentina also has reached an agreement, still to be ratified by the Peruvian Government, under which Peru will supply petroleum to the value of $20,000,000 in exchange for wheat, cattle, and other Argentine agricultural products.

Italian Firm Purchases Venezuelan Royalty Oil

Permolio, S. A., an Italian corporation, has bought the 115,000 bbl. of royalty oil recently announced for sale by Venezuela. The Italian firm bid $2.70 a barrel, announced as the minimum for which it would be sold.

The oil originally was a part of royalty oil sold by the Venezuelan Government to Sacor, a Portuguese company, at $2.545 a barrel. When this firm was unable to lift the oil, Venezuela again invited bids on it.

Venezuelan Crude Output Again Reaches New All-Time High

VENEZUELAN crude-oil production during the month of July continued its climbing trend of the past year, reaching a new level of 1,349,000 bbl. daily. As compared with production in January of this year, July's daily average output was 68,000 bbl. higher; it exceeded that of June by 11,000 bbl. daily. Practically all of the increased oil production was accounted for by higher output rates in La Paz field of Western Venezuela and Las Mercedes field of Eastern Venezuela.

The accompanying table lists the daily average output of the various operating companies in Venezuela for January, June, and July of this year. It will be noted that Creole's output has increased 37,000 bbl. during this period; that of V.O.C., 17,000 bbl. daily; and Caribbean, 6,000 bbl. The Las Mercedes company, following the completion of a pipe-line outlet to its Las Mercedes field, in July produced 8,740 bbl. daily. Another new company added to the producing list during the period was Richmond Exploration, which during July produced 355 bbl. daily from its new Boscan field west of Lake Maracaibo.

No Drilling Increase

Drilling operations, according to the report of Venezuelan Ministry of Development, continued at about the same level. At the first of August there were 134 rigs at work of which 63 were in Western Venezuela. During July, 70 wells were completed and 72 were commenced. Of the completions, 28 were in the western fields, as were 34 of the new locations.

The monthly report for the first time included figures on natural-gas production and utilization. The summary showed that a daily average of 1,303,000 M.c.f. of gas was produced during July of which 1,085,000 M.c.f. was vented to the atmosphere. Of the gas utilized, 113,200 M.c.f. daily was burned as fuel, 62,000 M.c.f. was used in natural-gasoline plants, 5,750 M.c.f. was sold, and 36,000 M.c.f. was injected into oil-producing reservoirs.

New Oil Well in Turkey Reported With Good Flow

A new oil well has been completed in the Ramandagh Mountains in southeast Turkey, according to a report from Ankara. The initial production test showed 420 bbl. daily.

The dicovery was attributed to the Turkish State Mining Research Institute. Drilling & Exploration Co. of Dallas and Los Angeles has a contract with the Turkish Government.

The Turkish minister of economy said no concessions would be granted to outside interests in the Ramandagh area. As a matter of fact no private interests have been granted rights in Turkey for many years.

(For other details on Turkish oil completions, see The Oil and Gas Journal, March 11, page 63, and March 18, page 79.)

German Crude Production Continues to Rise Slowly

Indigenous crude-oil production in Germany increased to 53,600 tons, approximately 13,400 bbl. daily, in July. This compares with the June output of 49,800 tons, 12,400 bbl., and with 49,700 tons, 12,425 bbl., for July 1947.

Improved supply situation of badly-needed materials was given as the primary reason for the increased July crude-oil output.

When official figures for August are released, it is probable that production will approximate 55,650 tons, or about 13,900 bbl. daily, the slight increase coming from the recently discovered Elwerath field near Stammerberg.

Meanwhile, imports of crude oil and petroleum products into the British zone of Germany during the second quarter of this year were double the amount in the first quarter, while those in the United States zone were up a third to 255,500 tons, 64,000 bbl. daily, and 135,000 tons, 34,000 bbl. daily, respectively.

VENEZUELAN OIL PRODUCTION BY COMPANIES
(Barrels daily)

	January 1948	June 1948	July 1948
Creole Petroleum Corp.	656,403	693,236	693,500
Venezuelan Oil Concessions	301,745	308,589	318,600
Mene Grande Oil Co.	184,813	182,697	182,200
Caribbean Petroleum Co.	63,119	70,224	69,000
Socony-Vacuum Oil Co.	28,784	30,814	30,550
Sinclair Oil & Refining Co.	19,570	19,474	18,900
Texas Petroleum Co.	12,103	12,786	12,700
Colon Development Co.	11,472	12,181	11,570
Phillips Petroleum Co.	1,858	1,577	1,380
British Cont. Oilfields	1,125	969	1,200
S.A.P. Las Mercedes	41	5,254	8,740
Richmond Exploration Co.			355
Orinoco Oil Co.	329	292	280
Venezuela Atlantic Refining Co.	86	155	90
Total	1,281,448	1,338,248	1,349,100

Uruguay Contracts for Reconnaissance Survey

A contract for a geological reconnaissance survey of Uruguay has been let to the firm of DeGolyer & MacNaughton, Dallas, by A.N.C.A.P., the Uruguayan Government oil refining and distributing monopoly.

Object of the survey is to suggest the possibilities of oil production in the country and to determine locations for possible geophysical surveys and detail work on geological structures.

The survey will include a study and report on work of a similar nature previously done in Uruguay, surface exploration and geological mapping and profile, and possibly geophysical exploration if indicated by the findings. Work probably will start in the northern part of the country where prospects for discovery of oil appear most promising, and is expected to require from 2 to 3 years.

At present there is no crude production in Uruguay and no development concessions are held by any outside interests.

Mid-East Crude Sales Co. Is New Caltex Affiliate

A new affiliate of California-Texas Oil Co., Ltd., the Mid-East Crude Sales Co., Ltd., has just been organized for the purpose of handling crude oil sales to European refineries. The crude oil will be drawn from the Middle East, particularly Saudi Arabia and Bahrein.

W. F. Bramstedt, formerly a vice president of Caltex, has been named president. Walter Uhle, also formerly with Caltex, will shortly join Mid-East as assistant to the president.

Substantial quantities of crude oil are expected to be available in 1949 to Mid-East's refinery customers, Bramstedt explained. The new company will continue selling crude oil supplies to customers in Caltex world markets.

Reduced Allowables Cause Texas Output Drop of 19,000 Bbl. Daily

AUSTIN.—Texas crude-oil production in June showed a drop of nearly 19,000 bbl. daily as a result of action of the Railroad Commission in reducing allowables for that month.

Total indicated production in Texas in July averaged 2,443,325 bbl. daily as compared to 2,462,028 bbl. daily in the preceding month, according to the latest monthly crude-oil production and disposal report issued by the commission.

Another commission report covering gas production and gas-processing plant operations in June discloses a continued upward trend in both casing-head and gas-well gas output in Texas. Reported gas production in June averaged 8,679,325,000 cu. ft. daily against 8,666,663,000 cu. ft. daily in the preceding month of May.

The decrease in crude-oil output in Texas in July was caused by the commission's revisions in maximum efficiency rates of production effective that month. The monthly report shows that allowables in July totaled 2,617,817 bbl. daily, 73,586 bbl. daily less than in June.

A lower rate of underproduction largely offset the reduced allowables. Underproduction was 8.52 per cent of the allowable in June. The new schedules placed in effect in July cut this to 6.97 per cent.

More Gas Utilized

Total Texas crude production in July was 75,740,294 bbl. This includes 75,644,267 bbl. reported production and 96,027 bbl. in allowables of leases not reported.

Of the July production, 2,422,957 bbl. daily was disposed of through pipe lines against 2,446,031 bbl. daily in June. Remaining production was moved by tank cars and trucks and used as fuel.

By districts, production was 702,182 bbl. daily in Commission District 8 in West Texas in July; 494,867 bbl. daily in District 3 on the Upper Gulf Coast; and 424,564 bbl. daily in District 6 in East Texas. Total wells in Texas rose from 106,979 in June to 107,039 in July. Leases in the state increased from 22,990 to 23,119.

As for gas production, the trend toward increasing utilization, particularly by transmission pipe lines, apparently was more than sufficient to offset a usual seasonal drop. The commission tabulates all gas utilized but does not include casing-head flared in the field.

Total ultimate disposition of all gas averaged 8,679,325,000 cu. ft. daily in June, including 2,089,887,000 cu. ft. daily of casing-head and 6,589,438,000 cu. ft. daily of gas-well gas. The percentage of the total taken by transmission pipe lines showed an increase from 44.02 per cent in May to 45.31 per cent in June. Cycled gas returned to the formation dropped from 19.68 per cent in May to 18.85 per cent in June, and carbon-black usage declined from 12.10 per cent in May to 11.89 per cent in June.

Oil-well gas taken direct by transmission pipe lines rose from 7.84 per cent of the total in May to 9.19 per cent in June. Gasoline plant usage of casing-head also was up from 67.79 per cent in May to 69.32 per cent in June. Gas-well gas taken by pipe lines rose from 21.11 per cent in May to 22.12 per cent in June, and gasoline-plant usage of gas-well gas dropped from 40.39 per cent of the total in May to 39.64 per cent in June.

Penn State Secondary Recovery Program Planned

The twelfth annual Penn State conference on secondary recovery will be conducted in the School of Mineral Industries at Pennsylvania State College October 14-16.

A round-table discussion of laboratory and field work pertaining to current practices will be a feature of the program, according to Dr. S. T. Yuster, chief of the school's division of petroleum and natural-gas engineering.

A.S.M.E. Plans Varied Program at Amarillo

Technical papers and talks on petroleum synthesis, production, transportation, refining, and materials problems will highlight the annual meeting of the American Society of Mechanical Engineers, Petroleum Division, to be held in the Herring Hotel, Amarillo, Tex., October 3-6.

More than 500 engineers are expected to attend the 4-day meeting.

Speakers on petroleum synthesis will include W. C. Schroeder, chief of the Office of Synthetic Fuels, Bureau of Mines; Dr. Alfred Clark, Phillips Petroleum Co.; and Dr. C. W. Montgomery, Eugene Ayres, and Joe H. Hirsch, Gulf Research & Development Co.

Other speakers and their subjects will include D. O. Johnson, Tulsa, a new-type dynamometer for well weighing; Jim Gregory, Shell Oil Co., Inc., Long Beach, field control of oilfield equipment; and J. R. Mahan, director of engineering of National Supply Co., drilling rigs for deep wells.

Drilling Contractors to Meet October 11-13

The eighth annual meeting of the American Association of Oilwell Drilling Contractors will be held October 11-13 in the Rice Hotel, Houston.

Only one session will be held on the opening day, with the rest of the day to be devoted to committee meetings. The committees will make their reports Tuesday morning.

Speakers at the meeting and the subjects to be discussed include:

MONDAY, OCTOBER 11

President's address, E. C. Brown, Brown Drilling Co., Long Beach, Calif.; "The Drilling Industry's Current Public Relations Position," Paul Cain, Fred Eldean Organization, Inc., Dallas.

TUESDAY, OCTOBER 12

"Contractual Liability—What It Means," W. C. Morris, San Antonio; "Drilling Costs," Jack Abernathy, Big Chief Drilling Co., Oklahoma City; "Drilling and the Oil Demand," B. A. Hardey, Shreveport; "Desert Venture," film, comment by E. A. Skinner, vice president of Trans-Arabian Pipe Line Co., San Francisco.

WEDNESDAY, OCTOBER 13

"An Incentive Plan for Drilling Contractors," Thomas P. Pike, Thomas P. Pike Drilling Co., Los Angeles; "Results Obtained with High Nozzle Fluid Velocity Drag Bits," G. E. Cannon, J. P. Nolley, and Douglas Ragland, Humble Oil & Refining Co., Houston; "Cable Tool Drilling in the Appalachian Area," R. B. Anderson, Columbian Carbon Co, Charleston, W. Va.

Residual Fuel Export Quotas Advanced by OIT

WASHINGTON.—Faced with the possibility of a sharp cut-back in refinery operations because of lack of storage space for residual fuel oil, the Office of International Trade last week authorized exporters to move oil now against fourth-quarter quotas.

The OIT set up an export quota of 1,450,000 bbl. for the coming quarter, the same as for the present period, and began immedately to issue licenses.

Officials explained that the residual storage facilities in the coastal areas have been filling up rapidly and some refineries already have been forced to reduce operations because of inadequate storage space. A survey showed that on August 14 inventories at refineres and bulk terminals totaled 61,000,000 bbl., an increase of 13,000,000 bbl. over the same date last year.

Under the fourth-quarter quota, Mexico will get 360,000 bbl., Cuba 300,000, Sweden 100,000, Chile 90,000, Denmark 80,000, Switzerland 30,000, and Costa Rica 10,000, a total of 970,000 bbl.; 340,000 bbl. will be provided for government-sponsored projects and 140,000 bbl. will be held in reserve.

Navy Plans New Work In Alaska, Elk Hills

WASHINGTON.—The most ambitious program for work in Naval Petroleum Reserve No. 4 in Alaska was laid out for next summer at an interim meeting of the operating committee at Fairbanks this month.

Returning to Washington last week, Com. William G. Greenman, director of naval petroleum and oil shale reserves, reported that three new wells will be drilled, one with a rig capable of reaching 15,000 ft. although it has not yet been determined how deep it will go. Several core holes also will be sunk. The Geological Survey will put five geophysical parties in the field, and there will be a general increase in personnel in several branches, including expansion of the laboratory at Fairbanks to include a paleontologist.

More Funds Available

Greenman said that with the additional funds granted by Congress last session, his office now can undertake operations on a much larger and more satisfactory scale. All of the equipment necessary for next summer's work has been landed in Alaska and two-thirds of it moved from the beach in anticipation of its movement to operating sites by tractor-drawn sleds as soon as traction firms up.

The latest report on Elk Hills operations shows that 12 locations are being prepared in the reserve for development of the Stevens zone and drilling will start as soon as steel is obtained, probably before October 15. The new arrangement with Standard Oil Co. (Calif.) for inclusion of new areas to the northwest of the present boundary under the unitization plan has been practically perfected and may go to the attorney general for review within a month.

BIR Clears Status of Contract Oil Workers

WASHINGTON.—Regulations defining who is an employe under the protection of the Social Security Act was amended by the Bureau of Internal Revenue last week to meet restrictions imposed by Congress.

The bureau's action signalized defeat of an effort to bring under the act several hundred persons generally considered to be independent contractors, including filling-station and bulk-plant operators tied to single oil companies.

Strong protests were voiced by employers who would be subject to social security taxes on these people when the proposed rule was announced by the bureau last November, and the matter eventually reached Congress, where the bureau was roundly criticised for attempting to invalidate the traditional definition of employment. Legislation was enacted last June defining the Social Security Act as applying only to individuals who are in an employe status under the usual common-law rules applicable in determining the employer-employe relationship.

To conform to that measure, the bureau went over its regulations and in all sections defining the term "employe" added a clause that "such term does not include (1) any individual who, under the usual common-law rules applicable in determining the employer-employe relationship, has the status of an independent contractor or (2) any individual (except an officer of a corporation) who is not an employe under such common-law rules."

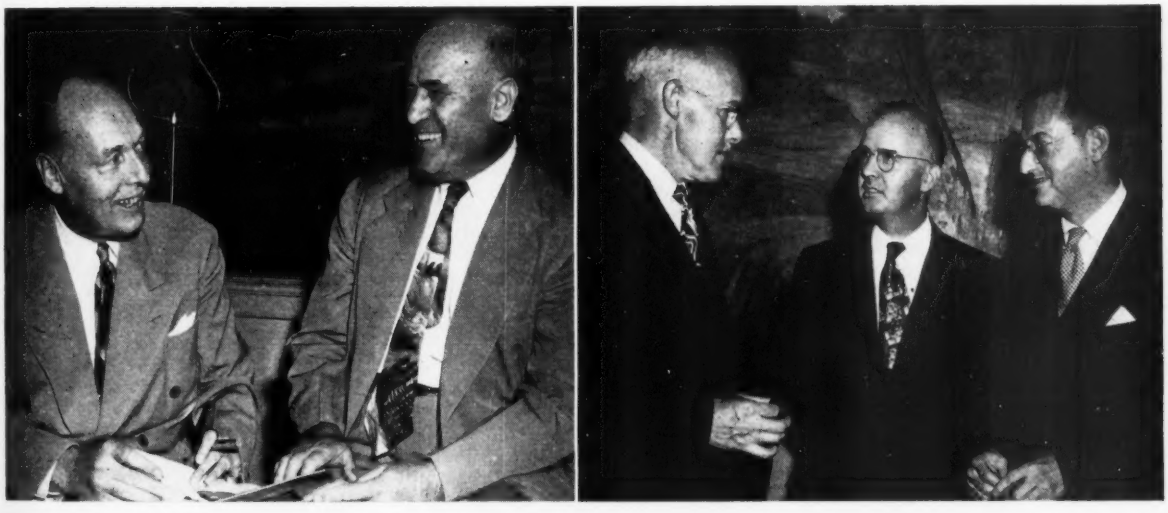
Navy's Fuel-Oil Loans Are Now All Repaid

WASHINGTON.—All of the 44,138,640 gal. of fuel oil loaned by the Navy to 11 states and the District of Columbia at the height of the fuel emergency on the East Coast last winter has now been returned, it was announced last week.

To meet spot shortages throughout the area, the Navy, at the direction of President Truman, released 19,345,200 gal. of bunker C, 16,397,640 gal. of Navy diesel and 8,395,800 gal. of Navy special fuel oil, all that could be spared above minimum stock requirements.

The loans were made to Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New York, Pennsylvania, Rhode Island, South Carolina, Vermont, and Virginia, in addition to the District of Columbia. Most of the states were able to repay their loans during the spring, but one or two were able to secure the necessary supplies only recently.

SHELL'S SYNTHETIC GLYCERIN PLANT DEDICATED



Among the officials in Houston September 16 for the dedication of Shell Chemical Corp.'s new synthetic glycerin plant were: Left photo, Jan Oostermeyer, New York, president of Shell Chemical, and Olin Culberson, Austin, member of the Texas Railroad Commission, and right, L. V. Steck, New York, vice president of Shell Chemical; B. M. Downey, manager of the Houston plant; and W. P. Gage, New York, vice president of Shell Chemical. The new $8,000,000 plant, first anywhere to make synthetic glycerin, utilizes propylene from the cracking operations of the adjacent refinery of Shell Oil Co., Inc., by a process described in The Oil and Gas Journal, September 16, page 88

WASHINGTON WATCHING

BY BERTRAM F. LINZ

Steel Squeeze

WASHINGTON.—A show-down between the steel industry and the Government over the allocation of product appears to be shaping up as a result of increasing demands from additional consumer groups for agreements covering their steel needs.

So far, almost a third of the expected production of steel plate through the remainder of the year has been earmarked for a half-dozen purposes, including tankers, barges, and oil-field tank and other equipment. Groups whose needs have not been covered in these agreements are clamoring for similar protection of supply.

The steel industry hasn't protested any of the agreements thus far made, but it does believe that allocations should be provided only for consumers whose activities are essential, directly or indirectly, to the national defense. Stiff opposition will be offered to any efforts to channel steel to groups that cannot meet that test.

Steel makers are somewhat concerned over the general acceptance of the argument that allocations can go much further because they now amount only to something less than 10 per cent of the steel output. That argument is fallacious, they say, because, as shown, 30 per cent of the plate production has been disposed of, and allocations of tubular goods and line pipe were not asked by the Commerce Department because the capacity output of the mills already was earmarked.

The major fear of the industry appears to be that the allocation of some products might be carried to the point where it would result in disorganization in lines which must depend on the "free" market for supplies and lead to demands for a new deal in which the Government would directly control the distribution of all steel, which would involve an indirect control of the steel-consuming industries.

Europe Stalls

BUSINESSMEN returning from Europe are charging that politicians in the Marshall-plan countries are stalling the European recovery program by concentrating on immediate relief requirements rather than those bearing on long-term recovery.

Europe's basic recovery requirement is for productive equipment that will enable the Marshall-plan countries to supply their own needs and in addition offer goods for interchange in a free competitive market. Most of the countries, however, have no dollars with which to buy productive equipment and can secure it only with American money granted them through the Economic Cooperation Administration, but approval of expenditures for such purposes comes not from the United States but from local authorities set up in each country.

Recent surveys indicate that many of the Marshall-plan countries are chiefly interested in meeting their immediate commodity needs, thereby forcing their industries to buy equipment, which may be inefficient for the purposes intended, from any source that does not require American dollars.

American equipment manufacturers are considerably disturbed over evasion of one of the principal purposes of the recovery program under which they expected to get several billion dollars' worth of business, and undoubtedly will make their views known to Washington next year when Congress considers the recovery appropriation for 1950.

Cars Needed

THE nation's railroads are in better shape today to meet the stress of war than they were in 1939, but could not maintain a war level of transportation long, according to spokesmen for the railroad industry.

While 110,000 freight cars are on order at the present time, new cars are being delivered so slowly that the total is increasing at a very low rate—only 12,700 during the 12 months ended June 30. On that date the Class I railroads had 2,000 fewer cars than on June 30, 1946.

The current freight-car building program calls for 10,000 a month, including tank cars, and an allocation of steel for that volume of construction is provided in a voluntary agreement adopted by the steel industry, but actual deliveries have not reached that figure. Railroad officials declare there is an immediate and imperative need for steel to construct at least 12,000 new cars a month.

The House interstate commerce committee dug into the railroad situation last June, when it was told by top men in the industry that the present financial reserves of the railroads are not adequate to carry out the capital improvement program necessary to maintain a transportation plan prepared for any national emergency.

At the same time, it was warned, no war can be successfully prosecuted under modern conditions without adequate and efficient railroad service.

As was proven during the last war, when none of the terrific transportation jams such as jeopardized our efforts in the first World War developed, the carriers believe emergency services can be provided better through private operation than by Government, but to insure that necessary service is available in the event of war the necessary equipment must be provided in time of peace.

Reparations Reviewed

BACK toward the end of the war, the then Secretary of the Treasury developed what became known as the "Morgenthau plan" under which Germany was to become merely an agricultural state. That plan, fortunately, was modified, but one almost as bad was developed by the four big allied powers, to remove from Germany every factory and plant that by any stretch of the imagination could be converted to the production of anything useful in war.

A a result of this latter plan, the American people have been digging into their pockets for the past 3 years to keep the Germans alive, and it is estimated that in the current fiscal year the United States will spend considerably more than a billion dollars in providing for the people in the American, French, and British zones.

Members of Congress who are watching the budget are beginning to question the wisdom of the plan to strip Germany of its productive capacity, and the recent disclosure that equipment from 916 dismantled plants currently is scheduled for shipment outside of Germany as reparations, part of it to go to Russia and behind the Iron Curtain to Albania, Czechoslovakia and Yugoslavia, doesn't make them feel any more comfortable.

The matter was brought out into the open recently by Sen. Styles Bridges of New Hampshire, chairman of the joint congressional "watch dog" committee which checks on the activities of the Economic Cooperation Administration.

In a letter to Economic Cooperation Administrator Paul G. Hoffman, Bridges pointed out Congress instructed the ECA to make a survey of dismantling schedules with a view to keeping in Germany such equipment as can be used to reduce our

occupation costs, and particularly to see that no more goes to Communist countries.

Kicking around in Washington is a secret report made last July by the Cabinet Technical Mission covering the entire reparations question. The mission recommended that its findings be made public, but although the information is available to the British and French officials who cooperated in the study, the information never has been released.

Experience already has demonstrated that so long as an industrial vacuum exists in Germany, European recovery will be retarded. The billion a year we are spending for maintenance of the German economy, therefore, is only part of the bill incurred in helping other European countries produce things which normally they would have imported from Germany.

Labor Eyes Profits

RUNNING an appraising eye over the balance sheets of the nation's corporations, the American Federation of Labor has come to the conclusion that many companies have raised prices far above costs in order to increase profits as an easy way to get capital and it is high time that industry, labor, and agriculture got together on a joint voluntary program to stop inflation.

But unlike the C.I.O., its rival, the A.F.L. is not worried over corporate profits, except as they may tend to deflate purchasing power, viewing the large reserves now being piled up as management's prudent hedge against the business recession it thinks may be around the corner. Such reserves may make it possible for companies to stay in business during a depression and thus keep workers employed who otherwise would lose their jobs, as well as afford the money for new plants and equipment to give more workers jobs and protect our living standards.

Corporate net income this year will be more than three times what it was in the best prewar year. But, with the single exception of 1946, corporations since 1942 have been paying more in taxes than they could count as net income before the war. Undistributed profits also run to more than the net in 1929, our best prewar year.

Those comparisons, however, are on a dollar basis and the dollar isn't what it used to be. On a percentage basis, things are a little different; federal and state taxes take 39 per cent of corporate income today compared to 14 per cent in 1926-29, and the $11,200,000,000 undistributed profits for the first half of this year was only 37 per cent of the total profit before taxes while in 1926-29 30 per cent of the much more valuable dollars was retained. And out of that 37 per cent, industry is trying to make up the 15-year lag in plant expansion caused by the depression and the war.

Record Attendance at A.I.M.E. Meeting Seen

A RECORD-BREAKING attendance is anticipated at the 3-day meeting of the North Texas Section of the American Institute of Mining and Metallurgical Engineers, Petroleum Division, to be held in Dallas, October 4-6.

Advance registration will open Sunday evening, October 3, in the Adolphus Hotel, with the first technical sessions scheduled to begin at 9 a.m. the following morning.

An open meeting of the Petroleum Division executive committee at 2 p.m. on the final day will close the 3-day event. Following is a list of papers to be presented at the meeting:

MONDAY, OCTOBER 4

Technical Session—Reservoir Engineering

9 a.m.—"Estimation of Reserves and Water Drive from Pressure and Production History," E. R. Brownscombe and F. A. Collins, Atlantic Refining Co., Dallas; "Effects of Transient Conditions in Gas Reservoirs," D. T. MacRoberts, United Gas Pipe Line Co., Shreveport; "Flow of Fluids in Oil Reservoirs and the Application of the La Place Transformation," A. F. Von Everdingen and William Hurst, Shell Oil Co., Inc., Houston; "Capillary Pressures—Their Measurement Using Mercury and the Calculation of Permeability Therefrom," W. R. Purcell, Shell Oil Co., Inc., Houston.

Technical Session—Gas and Gas Hydrates

9 a.m.—"Methane Hydrate at High Pressure," Riki Kobayshi and Donald L. Katz, University of Michigan; "Gas Hydrates of Carbon Dioxide—Methane Mixtures," Carl H. Unruh, C. F. Braun & Co., Alhambra, Calif., and Donald L. Katz, University of Michigan; "Effect of Antifreeze Agents on the Formation of Hydrogen Sulfate Hydrate," Donald C. Bond and Nelson B. Russell, Pure Oil Co., Winnetka, Ill.; "Solubility of Natural Gas in Oilfield Brines," William H. Ashby, Jr., California Co., Natchez, Miss., and Murray F. Hawkins, Louisiana State University.

Technical Session—Reservoir Engineering

2 p.m.—"Theoretical Generalizations Leading to the Evaluation of Relative Permeability," Walter D. Rose, Gulf Research & Development Co., Pittsburgh; "Method of Establishing a Stabilized Back-Pressure Curve for Gas Wells Producing from Reservoirs of Extremely Low Permeability," E. R. Haymaker, C. W. Binckley, and F. R. Burgess, Phillips Petroleum Co., Bartlesville; "Use of Permeability Distribution in Water Flood Calculations," W. E. Stiles, Core Laboratories, Inc., Dallas; "Effect of Permeability Stratification on Cycling Operations," Morris Muskat, Gulf Research & Development Co., Pittsburgh.

Technical Session—Well Logging and Drilling Mud

2 p.m.—"Relationship of Drilling Mud Resistivity," H. W. Patnode, Gulf Research & Development Co., Pittsburgh; "A Quantitative Analysis of the Electrochemical Component of the S.P. Curve," M. R. J. Wyllie, Gulf Research & Development Co., Pittsburgh; "Acoustic Impedance Logging," C. H. Kean and F. N. Tullos, Humble Oil & Refining Co., Houston; "Factors Involved in Removal of Sulfate from Drilling Muds by Barium Carbonate," W. E. Bergman, H. B. Fisher, and Paul G. Carpenter, Phillips Petroleum Co., Bartlesville.

TUESDAY, OCTOBER 5

Technical Session—Limestone Production

9 a.m.—"The Dollarhide Field, Andrews County, Texas," Karl A. Mygdal, Pure Oil Co., Fort Worth; "Limestone Pore Space Studies," film, with commentary by Henry Schaefer, Stanolind Oil & Gas Co., Tulsa; "Some Examples of Fluid Flow Mechanism in Limestone Reservoirs," W. O. Kellar and R. A. Morse, Stanolind Oil & Gas Co., Tulsa; "Pilot Gas Injection—Its Conduct and Criteria for Evaluating Results," Lincoln F. Elkins and John T. Cooke, Sohio Petroleum Co., Oklahoma City.

Technical Session—Offshore Drilling and Mechanical Engineering

9 a.m.—"Oil in the Gulf of Mexico," Dean McGee and A. T. F. Seale, Kerr-McGee Oil Industries, Inc., Oklahoma City; "Outline of Weather and Wave Forecasting Techniques," Alfred H. Glenn, meteorological consultant, New Orleans, and Joe E. Graham, Humble Oil & Refining Co., Grand Isle, La.; "Gulf of Mexico Floating Drilling Tender," C. P. Besse, California Co., New Orleans; "Hydraulic Drives on Modern Oil Field Equipment," H. A. Davis, Tulsa Disc Clutch Co., Dallas.

General Session

2 p.m.—"Semiautomatic Power-Operated Drilling Machinery," Martin E. True, Humble Oil & Refining Co., Houston, and Bert L. Stone, consulting engineer, Palos Verdes Estates, California; "The Core Recorder," Clark Millison, consulting geologist, Tulsa; "Desert Venture," film, with commentary by John R. Suman, vice president of Standard Oil Co. (N. J.), New York; "Private Financing of Oil Producing Properties," C. L. Rice, Jr., Empire Trust Co., New York.

Next Week

Drilling Boom in Gulf of Mexico.—The "big Gulf gamble" begins to pay off . . . seven discoveries so far. With this story freshly analyzing the huge Continental Shelf program, the Journal gives complete listing of all Louisiana and Texas offshore operations to date.

Processing Sour Crude.—Globe Oil & Refining Co.'s running of West Texas and Wyoming crudes is detailed from all operational standpoints.

New Catalytic Polymerization Unit.—Latest part of McMurrey Refining Co., Tyler, Tex., improvement plan.

And 1948 Exploration Is Running Higher!—Dr. E. A. Eckhardt, vice president, Gulf Research & Development Co., says the U. S. industry spent in 1947 a minimum of $105,000,000 on geophysical work alone. Distribution details are given.

Stanolind Offshore Rig Makes "Dry Run."—Stanolind Oil & Gas introduces the "proving ground" idea in testing a new big rig for future offshore drilling.

And . . . "How the Leduc Wild Well Was Killed," "Handling Sulfuric Acid Sludges," "Special Charts for Grade and Yield Estimation of Natural Gasoline," "Survey of Commercial Aviation Gasolines."

PERSONALS

Long Service Marks Career of H. F. Glair

GENERAL manager in charge of manufacturing of Standard Oil Co. (Ind.) is Harry F. Glair, who joined the company 42 years ago as timekeeper at its Whiting, Ind., refinery.

Glair began work with the company in 1906 upon graduation from Hyde Park High School, and a year later was transferred to the Wood River, Ill., refinery as a draftsman.

Subsequently he left the company to take a course in mechanical engineering at the University of Illinois, returning to the Whiting refinery in 1912 as an engineer.

In 1914 he was promoted to become assistant superintendent of the paraffin works in the refinery, and in 1920 he was made superintendent of the paraffin department.

In 1921 he became assistant general superintendent, in 1927 general superintendent, and in 1929 manager.

He was transferred to the general offices in Chicago in 1931 as assistant manager of manufacturing, and in 1933 he was promoted to his present position of general manager. He was elected to the board of directors in 1935.

B. Y. McCarty, assistant director of technical service of the Technical and Research Division of The Texas Co., New York, and **H. V. Atwell,** supervisor of fuels research in the company's Beacon laboratories, accompanied by **C. F. Teichmann,** vice president of Texaco Development Corp., are in Europe making a study of petroleum techniques on the continent. Headquarters for the group is Brussels, Belgium. They will make studies in Norway, Sweden, Denmark, Holland, France, Switzerland, Italy, Turkey, England, and the British-French-American zones in Occupied Germany.

Ben D. Jones, formerly assistant foreman of the administration department of the oil-movements division at Humble Oil & Refining Co.'s Baytown, Tex., refinery, has been made coordinator of line and tankage layout in the department. **Robert C. Read** has become assistant foreman of the refinery's pumping and gaging department, and **Jerold C. Cates** has been appointed mechanical coordinator in the pumping and gaging department. Also at Baytown, **W. J. Moore** has been made sheet-metal foreman; **Ben S. Love,** general foreman of the labor department; and **Barney L. Ward,** assistant general foreman of the labor department.

E. H. McCOLLOUGH

Edward H. McCollough, vice president in charge of operations of Amerada Petroleum Corp., has been elected to the directorate of the First National Bank & Trust Co., Tulsa. McCollough, associated with Amerada since 1925, assumed his present duties with the company in March, succeeding the late Allman M. Blow. Previously he had served as vice president in charge of Amerada operations in California and Canada, with headquarters in Los Angeles.

C. P. Bristol, chief exploitation engineer for the Houston area of Shell Oil Co., Inc., has been designated to attend the Advanced Management Course opening in September at Harvard.

R. R. Barr, drilling foreman in the production department of Shell Oil Co., Inc., has been transferred from Seeligson in the Corpus Christi division to Sheridan in the Houston division.

Ralph G. Rasco, Pure Oil Co. landman at Wichita Falls, Tex., has been appointed manager of the company's new district land department at Abilene.

Paul N. Kuzmich has joined the gas-engineering department of Manufacturers Light & Heat Co. as a corrosion engineer. Kuzmich is a 1946 graduate in petroleum engineering from the University of Pittsburgh.

F. C. FELLINGHAM

F. C. Fellingham has been named assistant administrative coordinator for Stanolind Oil & Gas Co. Fellingham has been acting administrative coordinator for several months during the absence of **V. E. Liles.** Prior to that he had served for 5 years as assistant manager of industrial relations. He became associated with Stanolind in 1931 when Stanolind acquired Dixie Oil Co., with which Fellingham was serving as a landman.

Donald Kelly has resigned as district geologist for The Texas Co. in North Texas to become an independent geologist.

Potter Hill has been appointed to succeed **Herm Lennartz,** who resigned recently as head of the district land office of Lion Oil Co. in Wichita, Kans.

Henry E. Meadows has been made division civil engineer for Humble Oil & Refining Co. at Midland, succeeding **Virgil A. Walston,** who has been transferred to Humble's headquarters at Houston.

G. H. Galny, Houston, has joined the geological staff of Continental Oil Co.'s North Texas district at Wichita Falls.

E. F. Semrad, gas engineer in the Oklahoma City office of Cities Service Co., has resigned to join Ford, Bacon & Davis Engineering Co. in Kansas City.

D. F. Gerstenberger, Spokane, Wash., Northwest representative for Ralph M. Parsons Engineering Co., will head a party leaving for China soon to study the Chinese oil industry,. under the sponsorship of the Economic Cooperative Administration. Gerstenberger, with a staff of engineers, will make an analysis of operations by the Chinese Petroleum Corp. at Taiwan, Formosa. He formerly was manager of a small West Coast refinery.

PERSONALS

George W. Graham and **Charles B. Christie, Jr.**, Wichita Falls, Tex., have been named directors of Wichita National Bank. Graham is a drilling contractor, as well as producer.

Norman Morrisey, Stanolind Oil & Gas Co. scout at Amarillo, Tex., has been transferred to the company's Tulsa offices. He will be on part time there while working on his master's degree in geology from University of Tulsa. **John Dyer** will be the new scout at Amarillo.

C. A. Chipman, Bolivar, N. Y., was elected president of New York Oil Producers Association at a meeting in Wellsville, N. Y. Other officers elected were: **M. E. Mitchell,** Wellsville, vice president; **Frank Hungerford,** Bolivar, secretary, and **William F. Hogan,** treasurer. Directors elected were: **John C. Bradley,** Chipman, **Winston Davis, H. W. Wunk,** Hungerford, **Leon MacDonell, Fred Shaner, John Thompson, Clarence Schaffner, Jr.,** and Hogan.

E. G. Bailey, president of Babcock & Wilcox Co., was guest speaker Wednesday at the Mid-Continent section meeting of the American Society of Mechanical Engineers held in Tulsa. Bailey is national head of the society. Subject of his address was "The Engineer's Opportunities."

Francis L. McFarren, Max Caplan, and **Abe Barber** have been appointed regional counsels for the Bureau of Land Management to handle public land problems. McFarren will be responsible for the Albuquerque, N. M., area; Caplan, Billings, Mont.; and Barber, Anchorage, Alaska.

Juan Bautista Siri, engineer, and **Alejandro Pena,** accountant with Administracion de Gas del Estado, Argentina, have been appointed to membership on the administrative council of that government agency.

M. S. Crossley has been appointed assistant treasurer of Consolidated Gas Utilities Corp. Crossley joined the company in 1930 and became general auditor in 1935.

Mario Lavarello, assistant director of industrialization of Yacimientos Petroliferos Fiscales, Argentinan Government oil agency, has returned to Buenos Aires after a 2-year residence in the United States.

The following appointments and transfers were made by Stanolind Oil Purchasing Co. effective October 1: **D. A. East,** formerly assistant comptroller, appointed manager of the executive department; **J. T. Perkins,** formerly manager of field operations, to Dallas as District representative; **D. R. Ryan,** formerly assistant manager, appointed manager of field operations department.

E. J. Strawn, regional automotive superintendent of Shell Oil Co., Inc.'s Houston office, has been elected regional vice chairman of the Texas Chapter of the Society of Automotive Engineers. Strawn has been with the automotive department of Shell the last 25 years and was automotive superintendent in Tulsa and Houston before his appointment to the regional staff in November 1946.

B. L. Clark, formerly associated with Stanolind Oil & Gas Co., has joined Warren Oil Corp. as district geologist with headquarters in Houston. Clark's appointment was one of three additions to the Warren geological and land departments announced last week by the company. **Wesley Davis,** formerly with Chicago Corp., has been appointed district geologist with headquarters at Corpus Christi, and **Richard W. Fry,** formerly with George W. Strake, has been named district landman with headquarters at Corpus Christi. Clark joined Stanolind in 1941 and had been with the company continuously except during the war, in which he served as a pilot in the Army Air Corps. Davis entered the oil industry with Shell Oil Co., Inc., later serving with Empire Gas & Fuel Co., Southern Minerals Corp., and Chicago Corp. Fry spent 6 years with Cosden Oil & Gas Co. and 7 years with Stanolind before joining Strake.

B. L. CLARK

R. W. FRY

WESLEY DAVIS

Edward S. Plank, formerly assistant gas-measurement superintendent for Tennessee Gas Transmission Co. in Houston, has been promoted to superintendent. He succeeds **E. N. Armstrong,** who resigned to become vice president of Cisco Hydrocarbon Co. with headquarters in Houston.

Gustavo Nettle, vice president of Cities Service Argentina, S.A., Buenos Aires, was in the United States in mid-September on a business trip.

Jack K. Baumel, chief engineer for the oil and gas division, Texas Railroad Commission, has been granted a year's leave of absence to assist the Venezuelan Government in setting up a conservation program in that country. He will leave for Venezuela about November 1.

R. M. Reeves has been appointed superintendent of the new Galveston marine terminal of Stanolind Oil & Gas Co. Reeves formerly was head roustabout at Lafayette, La. **R. E. Rowland,** formerly assistant field clerk at Woodsboro, Tex., has been named marine terminal clerk.

M. C. Hagar, formerly associated with the Sinclair companies, has been appointed general purchasing agent for National Cooperative Refinry Association, which is organizing a centralized purchasing department. Hagar's headquarters will be in the association's general offices in McPherson, Kans.

Lee J. Ledet, production foreman in Valentine field, Louisiana, for Pan American Production Co., has been presented the Joseph A. Holmes Safety Association medal of honor. **E. R. Turner,** president of Pan American, made the presentation at a fish fry attended by 200 Southern Louisiana employes of the company. Ledet received the medal for saving the life of **Odum T. Melvin, Jr.,** an oil barge captain, on Bayou LaFourche, near Lockport, La. Melvin was overcome by petroleum fumes in the hold of his barge and Ledet risked his life to enter the hold and rescue him.

Louis A. Beecher, of McDaniel & Beecher, Dallas, has been elected chairman of the recently formed Tenth District chapter of the American Association of Oilwell Drilling Contractors. Other officers are **Thomas J. Carter,** of Thomas J. Carter Drilling Co., vice chairman, and **R. V. Everidge,** Davidson Drilling Co., Fort Worth, secretary. Next meeting of the group is to be held October 4 in Dallas.

H. C. Arnold, vice president of Ashland Oil & Refining Co. in charge of the Mid-Continent office of the company, has resigned, effective Septem-

PERSONALS

ber 30. He will maintain connections with the company as a consultant.

James G. Craig has been named superintendent in charge of the offshore drilling activities of Continental Oil Co. Continental, while doing no offshore drilling now, is engaged with other companies in extensive exploratory work off the coasts of Texas, Louisiana, and California, which is expected to result in an offshore drilling program. Craig has been with Continental before, serving until a year ago as regional drilling superintendent in California.

SHIFTS—

H. D. Stanfill, engineer, Texas Eastern Transmission Corp., Summerfield to Batesville, Ohio; **Lawrence J. Beckmann,** geologist, Carter Oil Co., Denver, to Purcell, Okla.; **Earl Coleman,** foreman, The Texas Co,. McPherson to Victoria, Kans.; **Frank T. Jones,** engineer, Cities Service Co., Wichita, Kans., to Oklahoma City; **C. R. Temple,** engineer, The Texas Co., Tulsa, to Independence, Kans.

J. H. Galloway, superintendent, Humble Oil & Refining Co., Florey, Tex., to Los Angeles; **K. C. Woodyard,** foreman, Continental Oil Co., Edinburg to Harlingen, Tex.; **Lester H. Komarke,** superintendent, Parker Drilling Co., Brookhaven, Miss., to Andrews, Tex.; **C. C. McKenna,** engineer, Shell Chemical Corp., San Bruno, Calif., to Bayside, L. I., N. Y.; **N. M. Baird,** superintendent, American Republics Corp., Artesia, N. M., San Angelo, Tex.

Robert G. Mills, foreman, United Geophysical Co., Cotulla to Kenedy, Tex.; **J. S. Leonard,** superintendent, Ohio Oil Co., Knox City, Tex., to Reed City, Mich.; **Max C. Bailey,** engineer, J. S. Abercrombie Co., Seabrook to Texas City, Tex.; **Frederick L. Convers, engineer,** Stanolind Oil & Gas Co., Fort Worth to Midland, Tex.; **Francis Falcon,** engineer, Shell Oil Co., Inc., Odessa to McCamy, Tex.

Paul T. Bail, engineer, Stanolind Oil & Gas Co., Wink, Tex., to Huntington, W. Va.; **John R. Rider,** foreman, Amerada Petroleum Corp., Lake Arthur to Raceland, La.; **Roy T. Wesson,** superintendent, Spartan Drilling Co., Shreveport, La., to Magnolia, Ark.; **H. O. Button,** engineer, Socony-Vacuum Oil Co., Pitman to Woodbury, N. J.; **Frank A. Clauson,** engineer, The Texas Co., Roslyn Heights to Mineola, N. Y.

A. D. Boswell, engineer, Carbide & Carbon Chemical Corp., Charleston, W. Va., to Niagara Falls, N. Y.; **Clark M. Shimeall,** geologist, Ohio Oil Co., Kanah, Utah, to Durango, Colo.; **George E. Briggs, Jr.,** engineer, Stanolind Oil & Gas Co., Wilson to Wewoka, Okla.; **Henry W. Lam,** engineer, Atlantic Refining Co., Philadelphia, to Port Arthur; **Gordon W. Goode,** superintendent, Ohio Oil Co., McFadden, Wyo., to Medicine Bow, Wyo.; **Bernard J. Perry,** engineer, Shell Oil Co., Inc., Casper, to Afton, Wyo.

M. C. Brunner, superintendent, Shell Oil Co., Inc., Hobbs, N. M., to Midland, Tex.; **J. A. Beck,** engineer, Phillips Petroleum Co., Odessa, Tex., to Dallas; **Robert W. Barrett,** chemist, Socony-Vacuum Oil Co., Inc., Westville to Sewell, N. J.; **Edgar J. Gardner,** geologist, Gulf Oil Corp., Fort Worth to Wichita Falls, Tex.

E. E. Kennedy, superintendent, Mid-Continent Petroleum Corp., Kermit, Tex., to Hobbs, N. M.; **Frederick F. Dueser,** engineer, Republic Natural Gas Co., Ellinwood, Kans., to Golden, Colo.; **Kenneth A. Harper,** engineer, Sunray Oil Corp., Duncan to Bartlesville, Okla.; **L. C. Jarrell,** engineer, The Texas Co., Velma to Duncan, Okla.; **V. D. Miller,** superintendent, Noble Drilling Co., Tulsa to Hobbs, N. M.

William E. Kennett, geologist, Superior Oil Co. of California, Santa Maria to Paso Robles, Calif.; **Evan Watts,** foreman, Magnolia Petroleum Co., Tohatchi, N. M., to Belton, Tex.; **John Curtis Thrash, Jr.,** engineer, The Texas Co., Jal, N. M., to Odessa, Tex.; **Paul J. Vincent,** foreman, Sinclair Refining Co., Fort Worth to Beaumont, Tex.

T. L. Webb, foreman, Celanese Corp. of America, Kingsville to Luling, Tex.; **Ural A. Rowe,** foreman, General Geophysical Co., Lamesa to Haskell, Tex.; **W. M. Finley,** engineer, The Texas Co., Pampa, Tex., to Antlers, Okla.; **J. W. Richardson,** foreman, Amerada Petroleum Corp., El Dorado, Ark., to Winnsboro, Tex.; **R. H. Winn,** engineer, Halliburton Oil Well Cementing Co., Flora, Ill., to Houston.

Melvin L. Falk, engineer, Socony-Vacuum Oil Co., Inc., Wichita to Augusta, Kans.; **William F. Vineyard,** engineer, Universal Oil Products Co., Great Falls to Billings, Mont.; **Maurice Lewis, Jr.,** engineer, Shell Oil Co., Inc., Norman, Okla., to Tulsa; **Dr. A. Brodowski,** chemist, Shell Chemical Corp., San Francisco to New York; **William E. Perkes,** engineer, Tide Water Associated Oil Co., Whittier to Los Nietos, Calif.; **K. U. Schlegel,** Sinclair Products Pipe Line Co., Fort Worth, to Shawnee, Okla.; **J. M. Sappington,** superintendent, Absorption Plant, Inc., Houston to Big Lake, Tex.; **H. W. Roberson,** superintendent, Humble Oil & Refining Co., Wharton to Bay City, Tex.

DEATHS

Four oil-company employes were among the six Houston men killed September 12 in the crash of an Air Force Reserve training plane near New Orleans. They were: **S. E. Lambert,** 39, production engineer in Houston for Shell Oil Co., Inc.; **C. E. Lawler,** 28, employed in Shell's Houston research laboratory; **W. L. Page,** 28, employed by The Texas Co. in its printing department, and **W. T. Feray,** 38, employed by The Texas Co. in its stationery and supply department.

Alanson McDowell Gray, 74, died September 20 in Elizabeth, N. J. Gray was for many years president of Gray Process, Inc., Newark, and held many patents on oil refining equipment.

William V. Lester, 69, president of Trico Oil Co. and credited with the discovery in 1926 of Fry pool in Central Texas, died September 14 in Dallas.

John I. Taylor, 79, died September 16 in Tulsa. Taylor, former vice president of Margay Oil & Gas Co., retired in 1945 when that company was merged with Sohio Petroleum Co.

George Lee Bradford, 76, retired independent oil operator, died September 15 in Tulsa.

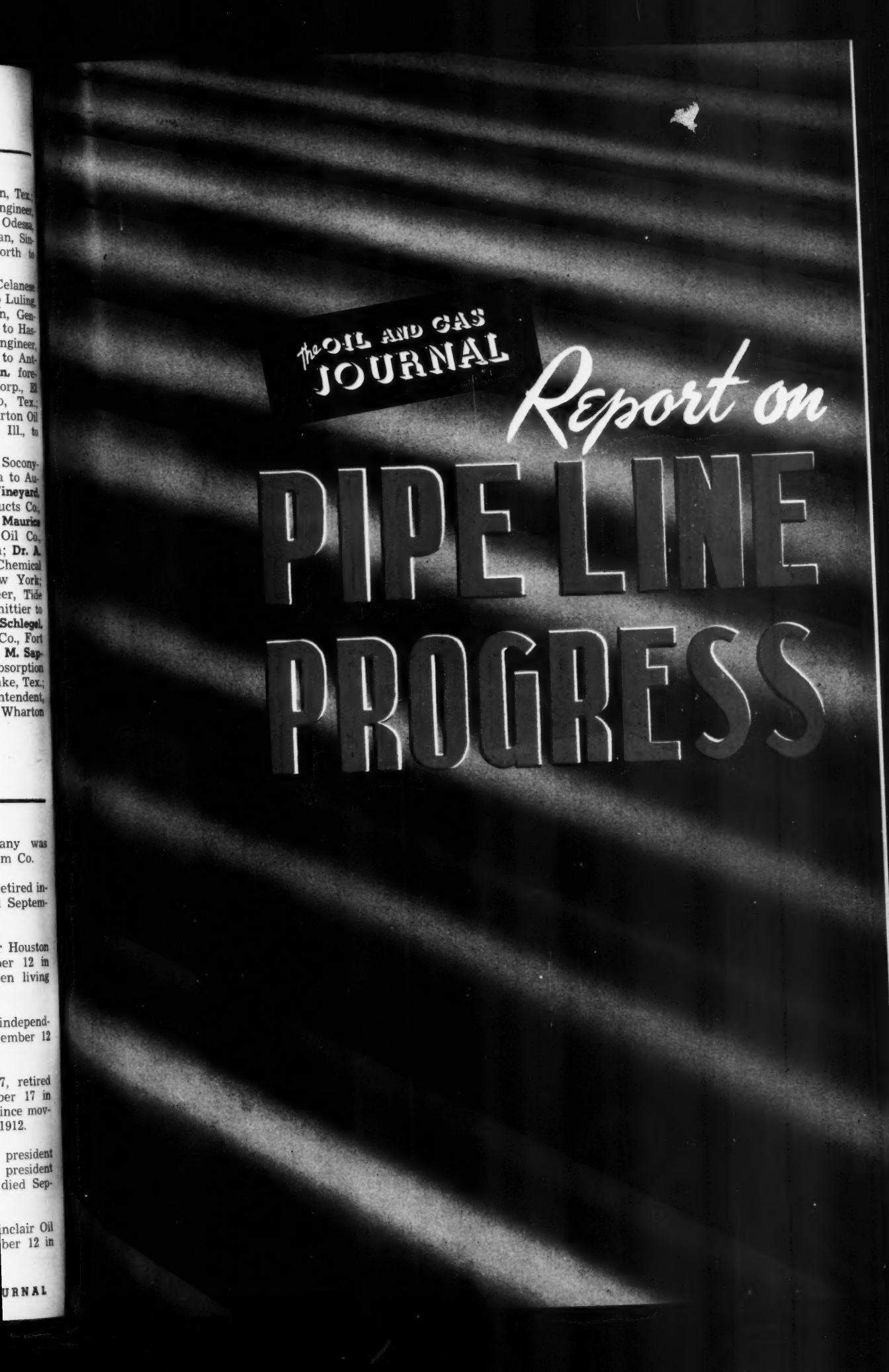
Pierce Withers, 53, former Houston oil operator, died September 12 in Chicago, where he had been living the last 2 years.

John Howell Shelton, 60, independent oil operator, died September 12 at his home in Dallas.

Joseph C. Kavanaugh, 67, retired oil producer, died September 17 in Tulsa, where he had lived since moving from Bradford, Pa., in 1912.

Neal E. Templeman, 55, president of Elaine Oil Co. and vice president of Olympia Royalties Co., died September 16 in Tulsa.

Edgar F. Swanson, 60, Sinclair Oil Corp. official, died September 12 in Bronxville, N. Y.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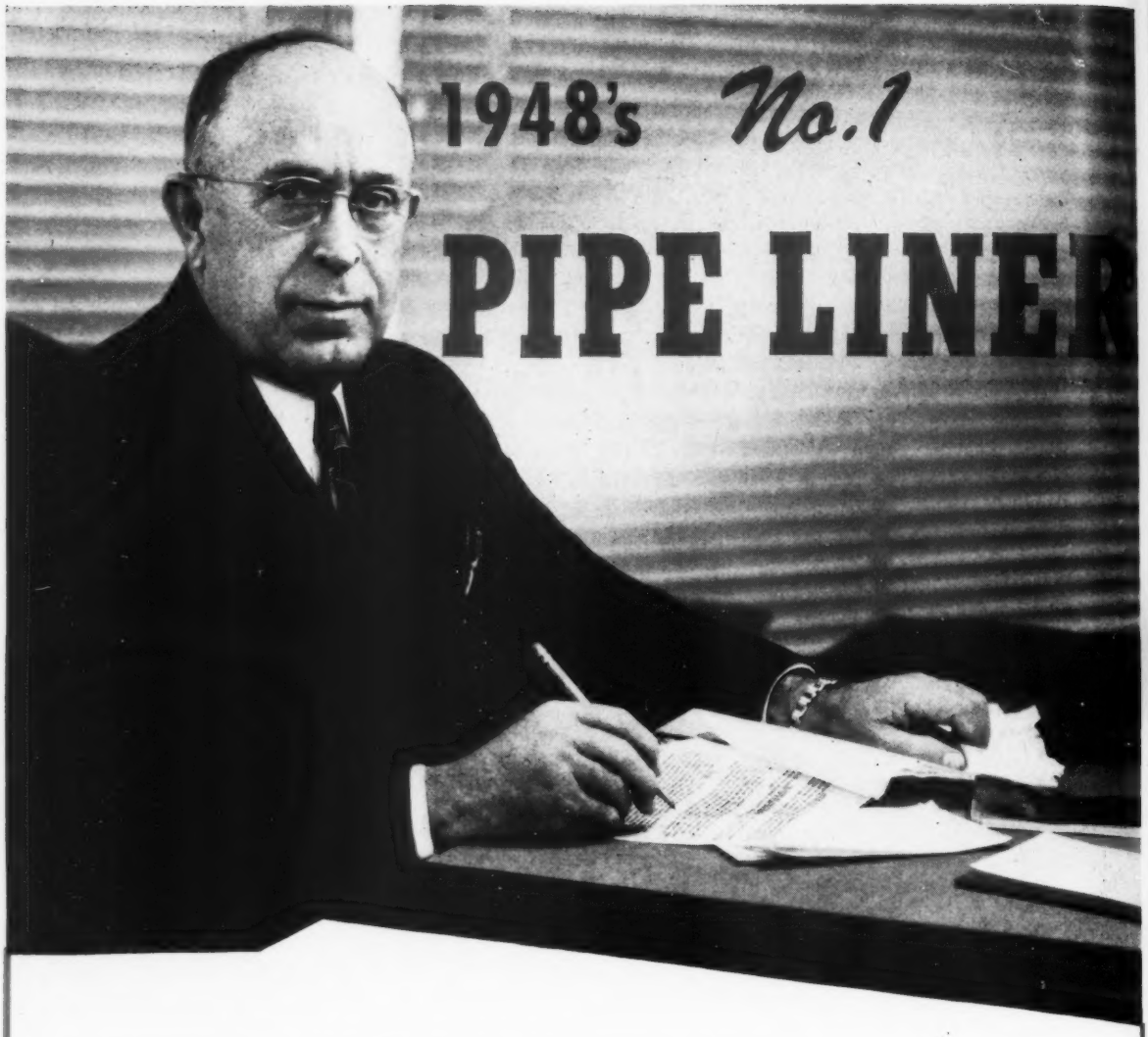


1948's No. 1 PIPE LINER

IF it were the custom of the pipe-line industry to single out an individual and bestow upon him the mantle of "Pipe Liner of the Year," in recognition of outstanding service and achievement, the recipient for the current year would undoubtedly be Burt E. Hull.

Hull is president of Trans-Arabian Pipe Line Co., the largest and in many respects the most important pipe-line project for the transportation of petroleum liquids now under way. His is the first construction of a program involving other operators which, within a period of 6 years, is expected to bring approximately 1½ million barrels of Middle East crude oil daily to world markets via big-inch pipe lines from the Persian Gulf to the Eastern Mediterranean. Two articles in this issue present the construction and economic features of the Trans-Arabian line.

He was born in Navasota, Tex., May 23, 1884. In 1904 he graduated from Texas A. & M. College with a degree of bachelor of science in civil engineering.

Following graduation he joined The Texas Co. pipe-line department as junior engineer, where he served for 4 years. Then he joined Texas' refining department as chief engineer, serving 15 years, when he was made vice president and general manager of The Texas Co. of Mexico, at Tampico. Four years later he became president of The Texas Pipe Line Co. and affiliates, at Houston.

As vice president and general manager of War Emergency Pipelines, Inc., he pushed construction and operation of the famous Big Inch and Little Big Inch lines which vitally contributed to accelerating the whole European campaign. Lack of WEP transportation, it is now agreed, would have delayed the Normandy invasion a year. Pipeline men from companies throughout the industry who have been associated in the great undertakings he has been directing know "Uncle Burt" as a courageous and considerate executive who is ready at all times to look hard facts squarely in the face.

In 1944 he was elected vice president of The Texas Co., with offices in New York, and 2 years later he was elected to the position he presently holds.

Burt Hull is now located at 200 Bush Street, San Francisco, from where he is directing the building of Tapline, although his home remains in Houston.

TRANS-ARABIAN LINE WILL BE OUTLET FOR 300,000 BBL. OF CRUDE

by Burt E. Hull

ARABIAN AMERICAN OIL CO. has been known for a long time by its abbreviated name of Aramco; likewise, its affiliate, Trans-Arabian Pipe Line Co., is now being called Tapline; Bahrein Petroleum Co., Ltd., is abbreviated as Bapco; and within a year or so you will begin to hear of the Mediterranean Refining Co. by its abbreviated name of Medreco.

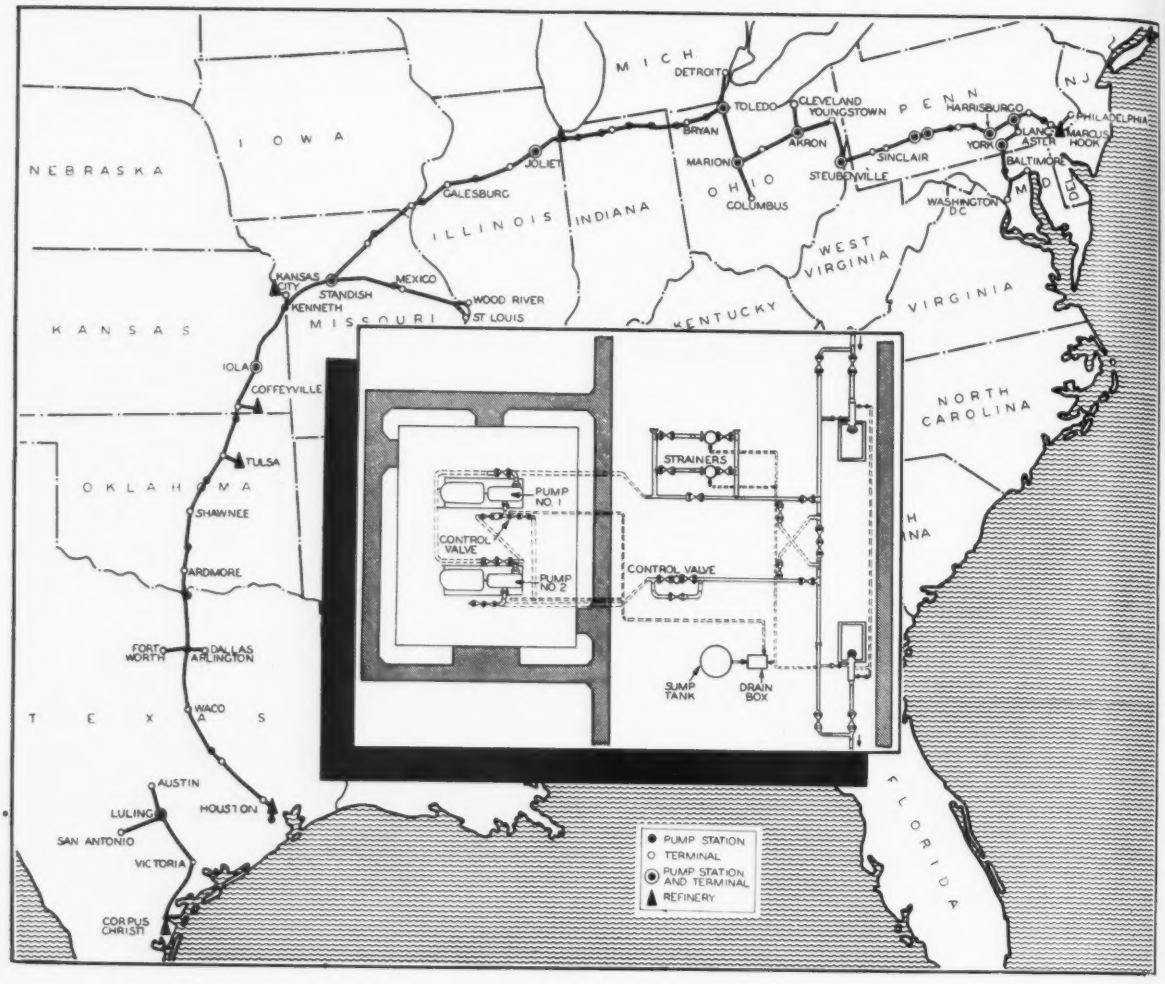
Aramco is producing 425,000 bbl. of oil daily from its Dammam, Abqaiq, and Qatif fields located in Saudi Arabia near the west side of the Persian Gulf. Tapline is trying to build 1,070 miles of 30-31-in. pipe line and a terminal, near the ancient city of Sidon on the Mediterranean coast, as an outlet for an additional 300,000 bbl., of which 75,000 bbl. will be delivered to the refinery Medreco is ready to start building at Sidon, and the remainder will be available for offshore shipment.

Tapline procured approval of its foreign project license from the U. S. Department of Commerce in January 1947 as authorized support for future export licenses which it must obtain quarterly from the Office of International Trade, an agency of that department.

The main line pipe was purchased from Consolidated Western Steel Corp. in January 1947. Consolidated was the only concern having assurance of an adequate supply of steel and prepared to begin delivering pipe last year in monthly quantity sufficient to complete the order within a reasonable period of years. It so happened that Consolidated's Maywood plant in Los Angeles was then manufacturing 30-in.-diameter pipe for Southern California Gas Co.'s line from the Colorado River crossing to Santa Fe Springs. Consolidated installed a second production line for 31-in. diameter pipe and started production on Tapline's order in September of last year. The 30-in.-diameter lengths are being inserted or nested inside the 31-in. lengths which reduces shipping space and shipping cost about 50 per cent.

OIT validated our export licenses for the third quarter of 1947 and the first quarter of 1948, but no official action was taken on applications for second and third-quarter licenses until June 19, when a notice was issued that validation would be deferred until September, then applications will be reviewed after allocations for fourth-quarter exports are established. This caught Tapline with 238 miles of pipe in Arabia, of which a stretch of 70 miles had been laid and connected on the extreme eastern end. Construction personnel and equipment had been organized for a completion schedule of January 1, 1950, subject to possible delays incident to coal miner strikes and other causes. Therefore, in July Tapline was obliged to retard its construction program so that construction gangs will not run out of pipe before the next shipments arrive. We can procure the pipe on schedule, but we are not permitted to ship it until export licenses are validated. The present interruption in the shipping

(Continued on page 270)



Map of the Sinclair Products Pipe Line System, details of which are described in the accompanying article. Inset shows a diagram of a typical station piping layout

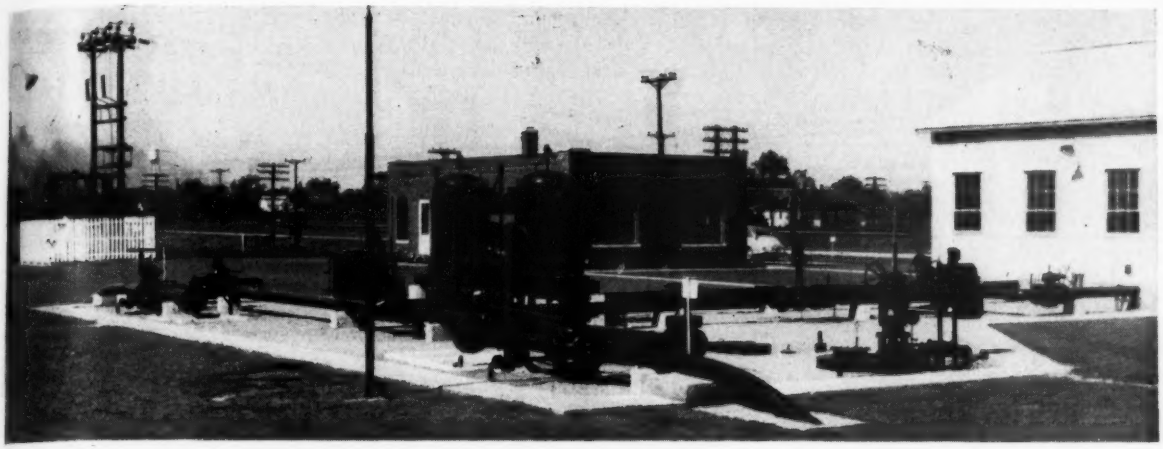
LAST SECTION OF HIGHLY UNUSUAL SYSTEM NOW BEING COMPLETED

by W. W. Baker

Flexibility is the keynote of this outstanding 2,800-mile products line, the industry's most extensive system for the transportation of refinery output. Efficiency, economy, safety, and a specially planned working-storage program are other important factors. The author is vice president of Sinclair Refining in charge of products pipe lines.

SINCLAIR REFINING CO. is completing the last section of a most unusual refined-petroleum-products distribution system. By linking its refineries and distribution centers into one large integrated, yet flexible products-pipe-line system, the difficulties of products transportation have been greatly reduced. The system is so designed that the supply of products at the refineries and the demand for such products at the distribution centers determine in which direction each line operates. Strategically located working-storage points allow the system to be broken into segments for supplying terminals, yet large "express" tenders can be rushed to their destination even while the intermediate sales terminals are being supplied.

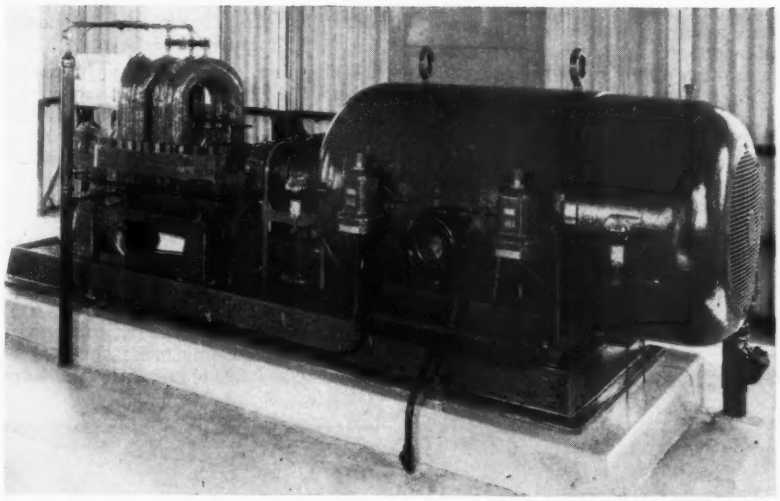
Sinclair began its products-distribution program in 1941 with the construction of its Pennsylvania line. This system originates at Sinclair's Marcus Hook refinery south of Philadelphia, and extends to the Ohio River at Steubenville, Ohio, with branch lines serving Baltimore and Washington. In 1943 the line between



Piping area of station No. 4 near Goshen, Ind., showing hay tanks, scraper trap, sump tank, and rear of pump building

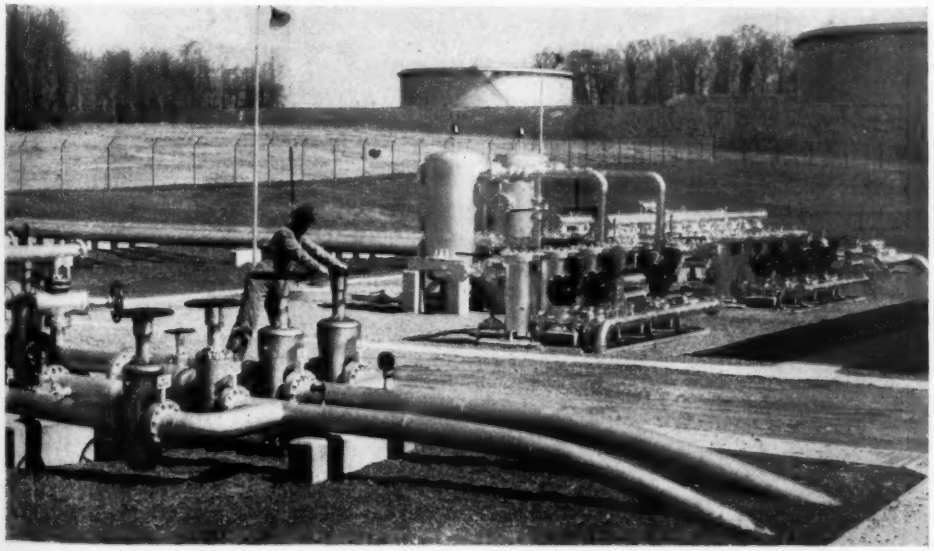
Chicago and Toledo was added. This segment aided the war effort by providing a continuous year-round supply of products to Lake Erie ports which hitherto were served by boats through the long circuitous lake route during the summer months only.

In 1945 the company's postwar expansion program gained momentum with the construction of a line supplying the Detroit area and other lines serving the Ohio industrial cities. It was this line from Toledo via Marion to Columbus, and from Marion to Akron with a stub to Cleveland, and from Akron via Youngstown to Steubenville which began to reveal the pattern of Sinclair's huge modern distribution program. This line linked two major refineries at East Chicago, Ind., and Marcus Hook, Pa., with a means of supplying the heavily populated Indiana, Ohio, Michigan, and Pennsylvania industrial areas from either point.



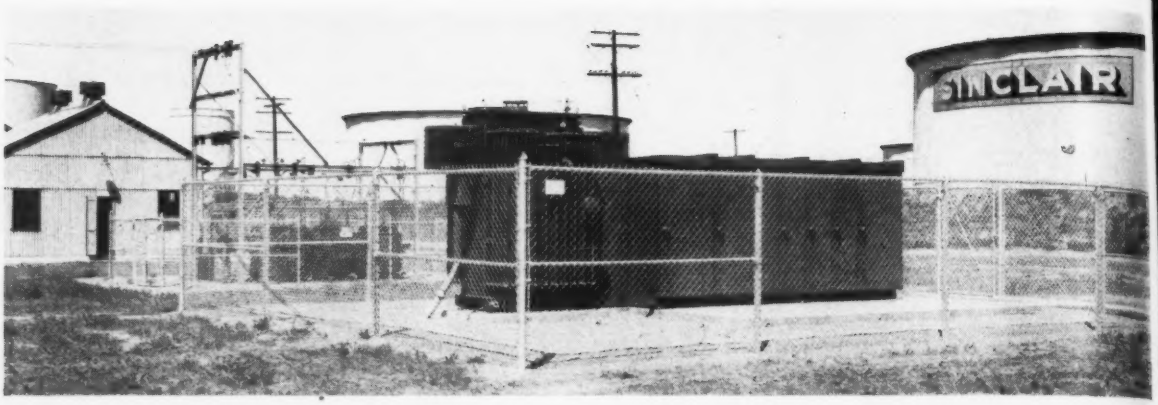
One of the main-line pumps at Toledo station directly connected to 350-hp. explosionproof motor protected with mercoid temperature control

Area picture of the Chelsea pump station with scraper traps in foreground, and the tank manifold, strainers, and meters in background



It was with the start of the Texas systems in 1946 and 1947 that the completed pattern was finally announced—a products-distribution system from Houston, through the more populous sections of the Midwest, to the Great Lakes, on to the Atlantic Seaboard.

In the selection of routes for all products lines, detailed studies were made of the population per square mile through the areas to be served. Thickly settled industrial and rural areas greatly influenced the ultimate routes selected as well as the location of modern dis-



Unit substation in operation at Toledo station, with 80,000-bbl. working storage tanks in background

tributing terminals. Minimum truck hauls, lateral rail facilities, together with the location of populated centers caused the lines to deviate from the conventional straight line. Zoning and other regulations forced the suburban location of some of the terminals, yet in several major cities terminals have been located as near to the center of distribution as possible, and pipe lines have been laid through city streets to reach the terminal locations. Outstanding in the feats of construction into cities is the line now being constructed through the city of Philadelphia; also the line laid into the heart of San Antonio, the lines emerging from Sinclair's refinery at East Chicago through Chicago suburbs; also, the lines into Detroit, Cleveland, Baltimore, and the District of Columbia.

Planning for Flexibility, Efficiency, Economy, and Safety

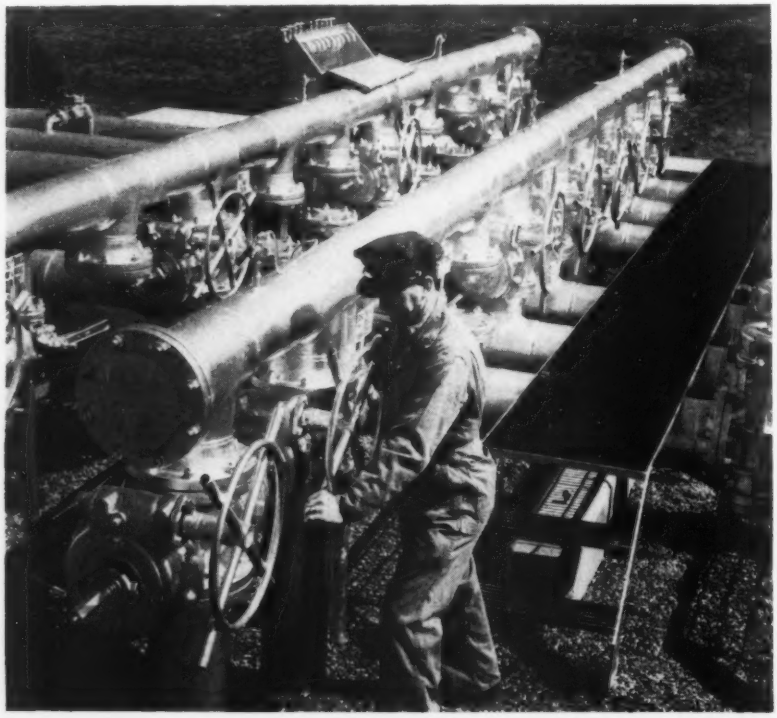
Of major importance in the operation of a long trunk system is the strategic location of working storage. This storage must be adequate in capacity to be able to receive or deliver a line fill of products from or to another receiving point. Flexibility must necessarily be the keynote of the operation of a products pipe line. Climatic conditions can overnight convert a record gasoline consumption into a heavy demand for fuel oil. By utilizing working storage to the fullest extent, preseasonal shipments can be batched along the lines, making the needed products available on short notice whether the demand is normal or abnormal.

A proper working-storage program also allows operation of a major portion of the line at all times even when the full stream is being delivered into terminals near the input station. Stocks are planned for these working-storage points so that when a delivery is being made, other terminals on the line can be served in either direction out of this stock. In this way the portion of line between working-storage points can be considered independent from the entire system and all demands can be satisfied promptly and efficiently with the minimum loss of pumping time.

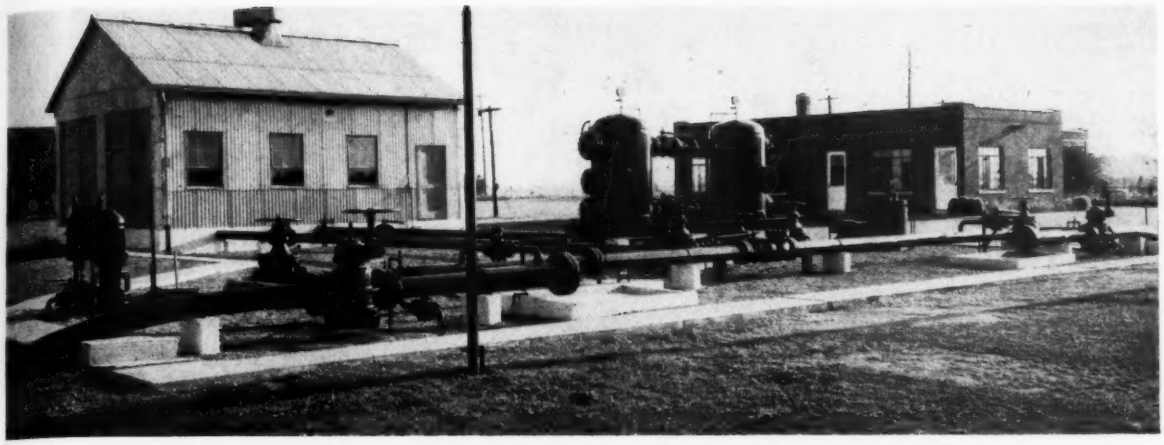
Another major consideration in planning a products system is standardization of design, equipment, and operation. Each station operator should be able to go from one station to another and be thoroughly familiar with each piece of equipment, its operation, and maintenance. Standardization allows interchangeability of equipment, and hence a large reduction in warehouse inventory to serve a number of pumping stations. Standardization of course also reduces design and construction costs.

One hundred per cent electrification of Sinclair's products system has greatly reduced initial costs and saved construction time. The ease of operation and maintenance with electric stations has many intangible values not wholly accountable in dollars and cents. Fewer employes are required to operate and maintain the system. Designing for full-voltage starting of large motors has further cut construction and equipment costs and has been sanctioned by practically all power companies.

Consideration for safety of the employe and property required a control building remote from the pump building. This arrangement eliminates the noise factor. The stations can be operated from the control building or pump building, whenever the need arises. The equipment can also be started or stopped at the remote unit-type substation. The high-voltage



Tank-line manifold at Chelsea pump station, which receives products from the Marcus Hook refinery south of Chelsea



Station piping at Bryan, Ohio, in foreground with Braden building at left and control in right background

equipment and all switchgear are in an outside weatherproof enclosure remote from both the pump building and the control building. The switchgear compartments are designed for complete safety of the operator. In no way could he accidentally come in contact with more than 110 volts. In case of a serious fire involving the entire pumping station, the station can be completely shut down by closing a remotely located "head" or "tail" valve. The usual fire extinguishers are provided.

Advance planning has permitted the installation of cathodic protection incident with pipe-line construction, which in conjunction with the use of an insulating coal-tar-enamel and felt wrapper gives complete and economical protection against stray and galvanic currents. Details of the cathodic protection program are discussed later under design features.

Planning a dependable communication system is a necessary adjunct to pipe-line operations. To obtain hourly reports, emergency calls, maintenance work, and routine operation over the entire system all coordinated into the general offices at Independence, Kans., has necessitated multiple-channel carrier equipment with private and confidential circuits to division and district offices, teleprinter service to all strategic points, and a physical dispatching circuit which is continuously in use. This huge communication system is composed of some leased wires, some newly constructed pole lines, some lines purchased from other interests and retransposed to fit into the integrated system, and some sections of cable with necessary test and repeater stations located at many points as required. Paralleling the entire pipeline network, needed circuits have been provided, consisting of the most miles of 30-kc transposed wires of any products system on the theory that a good communication system, properly maintained, is a vital and necessary part of any products pipe line.

Operation and Design Features

Initial operations began in 1942 on the Pennsylvania system. An office building constructed in Mechanicsburg, Pa., served as headquarters. The Pennsylvania system consists of an 8-in. trunk line from the refinery at Marcus Hook to a junction point at Schaefferstown south of Lebanon, Pa. From this point the system consists of two 6-in. lines, one running south to serve Lancaster and York, Pa.; Baltimore, and Washington, the other crossing the Allegheny Mountains to the west serving such points as Harrisburg, Altoona, Johnstown, Greensburg, Pittsburgh, Pa., and Steubenville, Ohio, on the Ohio River.

The system was built with single pumping units driven by 3,600-r.p.m. explosionproof motors for 2,300-volt operations. Mason-Neilan air-operated diaphragm control valves with parabolic plugs located on the discharge side of the pumps with control points on the inlet to the pump and the outgoing line serve as an "automatic pilot" for each station. Mercoid pressure and temperature controls serve as the "watchdog" which, in case any serious trouble develops,

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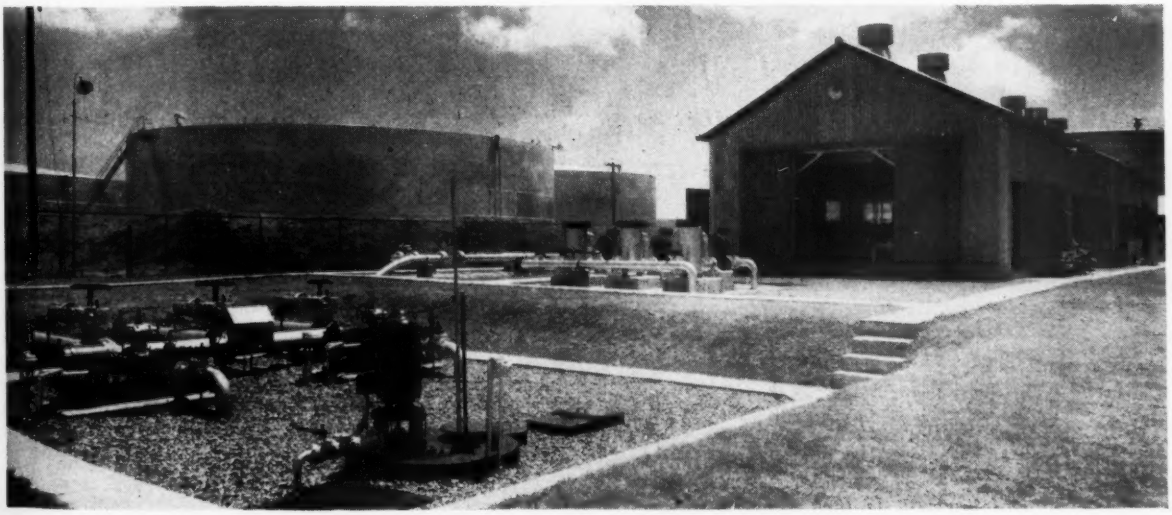
Nueces pump station at Corpus Christi, showing pump building in front and control building in rear



Pump-Station Design and Control Features of

Magnolia's 20-Inch Line

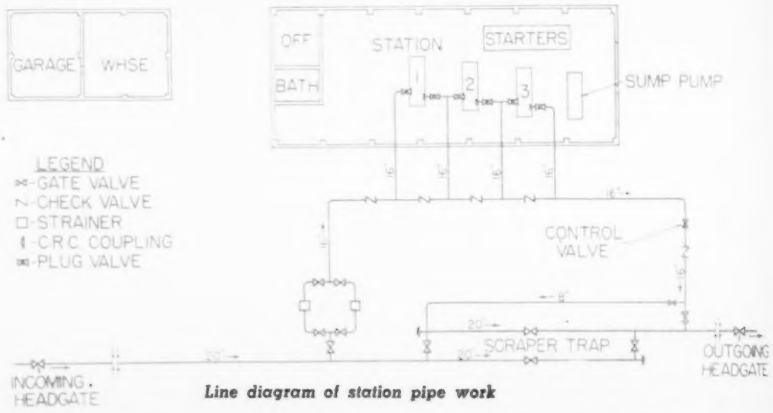
by E. J. Wacker*

View of station building and warehouse

IN June 1948 Magnolia Pipe Line Co. put into operation its new 648-mile 20-in. line from Corsicana, Tex., to Patoka, Ill. This supplies the missing link in Magnolia's system as it connects Magnolia's pipe-line system in Oklahoma, Texas, Louisiana, and New Mexico with the Midland division in Illinois, Indiana, and Ohio, and serves refineries in the St. Louis, Chicago, Detroit, and Buffalo areas. The line has a capacity of 100,000 bbl. per day.

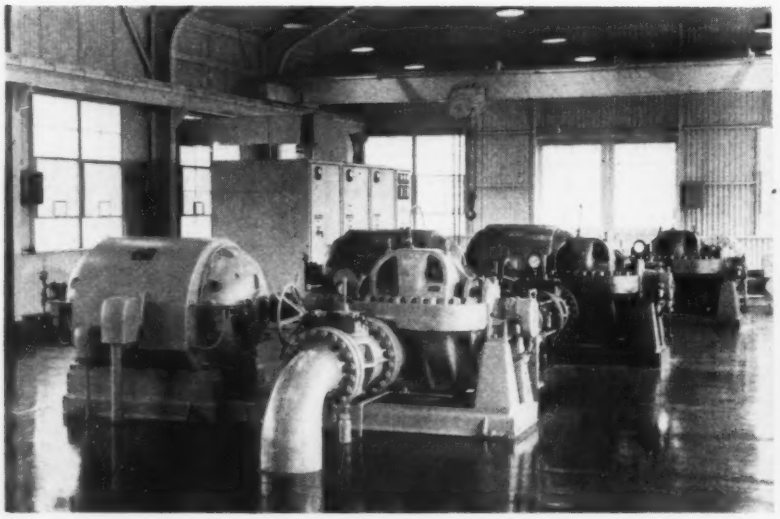
From the very outset the main theme in the station design was simplicity, coupled with efficient and reliable operation. The entire line, 648 miles with four pump stations, is operated as a closed system, dispatched by the chief dispatcher using telephone communication exclusively.

Each station is equipped with three motor-driven centrifugal pumps, two pumps operating in series with one spare unit. The three pumps at each station have different-diameter impellers with the following approximate head characteristics: No. 1, 250 psi.; No. 2, 350 psi., and No. 3, 400 psi. By having three different-size impellers it is possible to operate the line at different capacities without excessive throttling. Units No. 2 or 3 can be operated singly for 350 and

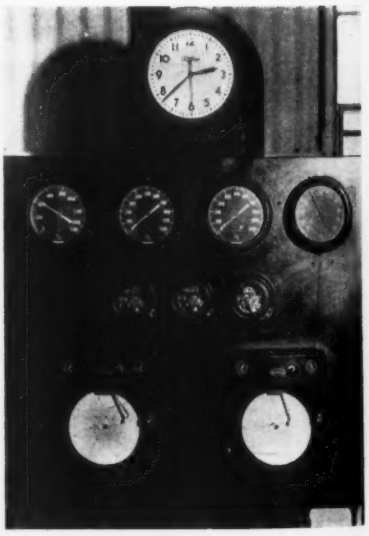


Line diagram of station pipe work

*Assistant chief mechanical engineer, Magnolia Pipe Line Co., Dallas.



View inside the station building



View of gage board

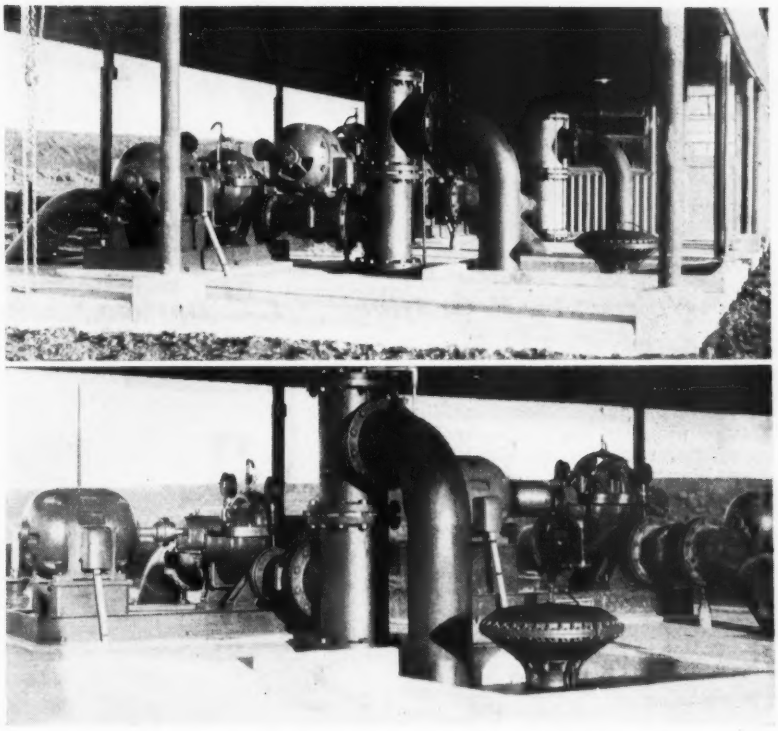
400 psi., or for series operation of two units 600, 650, and 750 psi. are available. The maximum station operating pressure is 800 psi.

The pumps are two-stage double-volute type, with both impellers of double suction design. The pumps are equipped with balanced single mechanical seals. The motors are 900-hp. 3,600-r.p.m. 2,200-volt induction type, equipped with sleeve bearings, which are flood lubricated by an external lube-oil pump. Each motor has its bearing and stator temperature thermocouples, which sound alarms in the event of overheating. The starting equipment is reduced-voltage type mounted in all-metal flush-type cubicles.

The main station buildings are of rigid frame-steel construction with corrugated asbestos roofing and siding. Ventilation is provided by three combination natural and forced-draft ventilators. Each buiding is equipped with a 5-ton overhead traveling crane. The office and bath are incorporated inside the main building with sound-proofed partitions.

Heating of the office and bath is by electric space heaters. No heat is provided for in the main building, as the losses from the 900-hp. motors will supply sufficient heat to keep the station reasonably comfortable. A combination warehouse and two-car garage of the same construction as the main building is provided at each station. At Corsicana the machinery was installed in the present brick building.

All valves outside the station building are series 400 cast molybdenum steel, rising stem, stellite seat ring and disk gate valves. Gate valves in the scraper trap and station loop gates are motor operated; all other gate valves are bevel-gear operated. The valves inside the station are gear-operated plug valves. A check valve is installed on the discharge side of each pump station on the downstream side of the 10-in. control valve to prevent the reverse flow of oil when the line is shut down and also to hold the static pressure at each station to a minimum. Each station has duplex strainers on the suction side of the main pump for protection against line trash.



Suction booster and radio control station on Corsicana tank farm

Pump-station pressures are controlled by Mason-Neilan pressure-control equipment. A recording suction controller and recording discharge controller are installed on the

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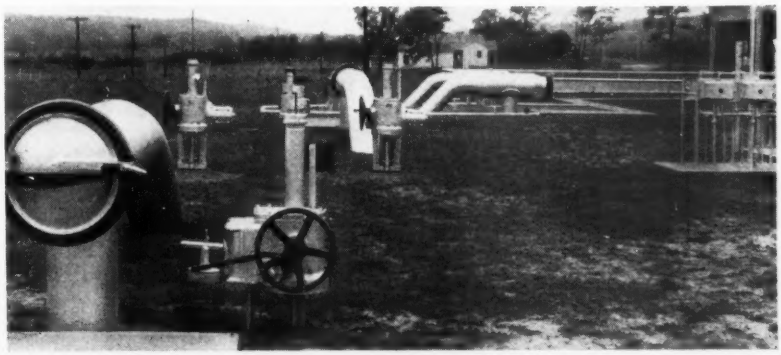
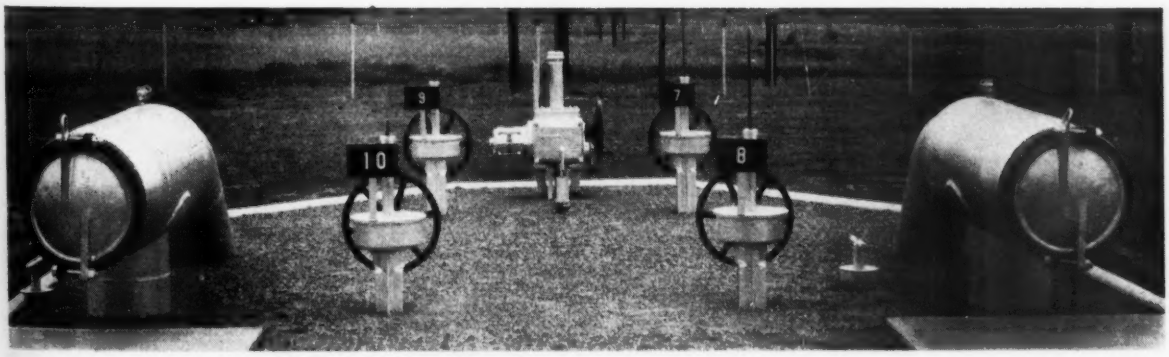


Scraper trap (left) and strainers (right)



View of incoming line strainers

ELECTRICAL FEATURES

Of Humble's Refined Products Pipe Line

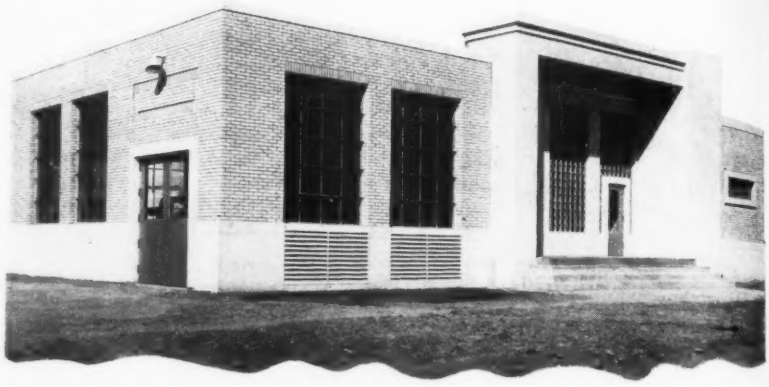
by F. O. Stivers, J. E. Barbee,* and M. A. Hyde†*

RECENTLY completed are two semiautomatic pump stations now in service on Humble Pipe Line Co.'s refined-products line from the Baytown refinery into the Dallas and Fort Worth area. At these stations, as in most similar installations, the use of semiautomatic operation has been made possible by the application of electric-motor-driven pumping equipment, and electrically controlled auxiliaries.

The station buildings are constructed of brick, stone, and tile, and have terrazzo floors and flat steel roofs. The modern design and materials used permit a minimum of maintenance.

Although the two stations are located over 100 miles apart on the 276-mile, 8-in. line, the design of each station is such that additional system capacity can be obtained by construction of intermediate stations with only minor changes in present equipment. An ultimate capacity of the system of 30,000 bbl. per day may be provided by the addition of three stations.

*Humble Pipe Line Co. †Westinghouse Electric Corp.



Hearne products station building

Originating at a point near Baytown, Tex., Humble's products-line system includes pump stations at Baytown and Hearne and delivery or take-off points at Houston, Waco, and Irving, near Dallas and Fort Worth.

The delivery facilities at all three terminals, Houston, Waco, and Irving, are of the same general design and include equipment for cleaning the delivered stream through excelsior-filled horizontal-type filters and vertical felt-wrapped basket strainers.

At the Baytown station, the incoming stream is received through filters and meters from remotely controlled suction booster pumps. Three main-line pumping units are installed at this location to provide a 50 per cent standby capacity for the normal two-unit-series operation of the centrifugal pumps. The receipt and delivery of products at all locations are based on positive-displacement-meter readings.

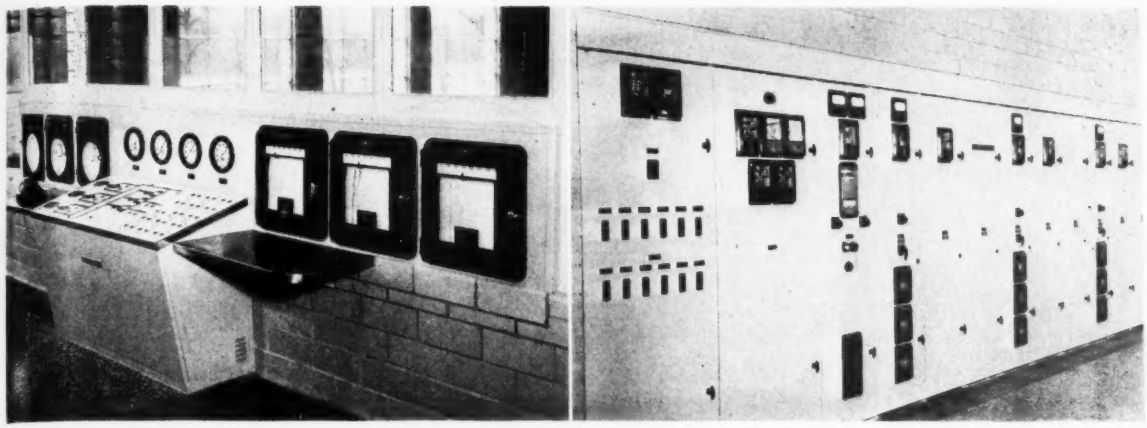
The Hearne pump station is similar in design to the originating station at Baytown with the exception that only two main-line centrifugal pumping units are provided and the added installation of metering facilities permits delivery of product at this point.

Auxiliary equipment and control for both stations includes such features as automatic pump venting suction and discharge-pressure control, motor-operated valves arranged for automatic sequence operation, and thermocouple-type temperature-recording instruments, in addition to the conventional auxiliary equipment of similar installations.

Pressure switches connected at various points in the station piping provide protection against extreme conditions which may damage equipment or lines.

All principal station functions are centrally controlled from an electrical control desk and associated gage panel installed in a separate control room

Hearne station meter area, showing meters and filters



Left: Control desk at Baytown station. Flowmeter and pressure controllers at left, pressure gages and electrical control at center, pyrometers at right. Right: Unitized metal-clad switchgear at Baytown station, showing (left to right) low voltage distribution, sequence control, main breaker control, and reduced-voltage starting equipment for three main line pump units

along with the indoor electrical switchgear.

Station design is such that two sections of the building are separated by a wire glass partition, on one side of which is the pump room from which air is exhausted; on the other, the control room, which is slightly pressurized by forced ventilation. These two areas are considered hazardous and nonhazardous, respectively.

The main-line pumps are driven by 400-hp., 3,600-r.p.m., 2,300-volt, squirrel-cage motors. These motors are of the explosionproof type, permitting them to be directly coupled to the pumps, without the necessity of an intervening fire wall. The motors have sleeve bearings, oil-ring lubricated, equipped with thermocouples for temperature indication and protection. Thermocouples are also included in the motor windings.

The pump bearings, glands, and casings are also equipped with thermocouples.

For each unit, the motor and pump thermocouples are brought to a recording pyrometer on the control-desk gage panel, where the temperatures are charted, and in case any of the temperatures exceeds a predetermined limit, the unit is shut down through an auxiliary relay system incorporated in the control desk.

The control desk also mounts for each pump unit a single start-stop pushbutton by which the unit is normally controlled. Coordinated to the motor control are the pump venting valve and the motor-operated suction and discharge valves, so that these function in correct sequence without attention by the operator.

At Baytown station the operator has pushbutton control at the desk over the two principal manifold header valves. To provide against misoperation of these valves with resultant product contamination, these valves are electrically inter-

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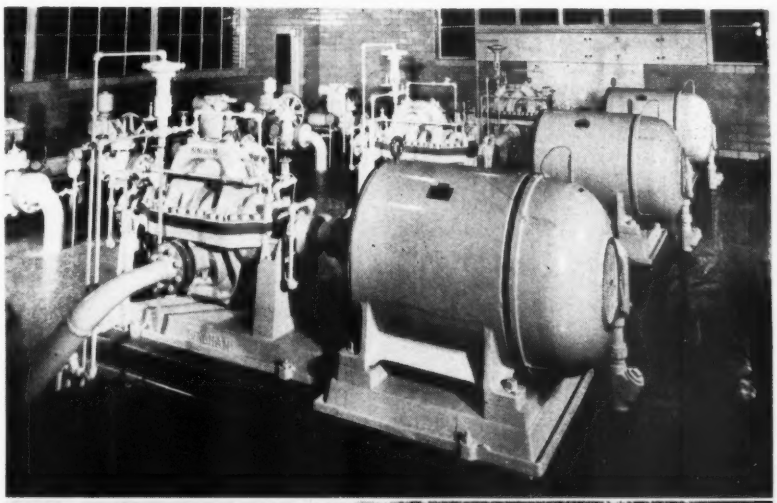
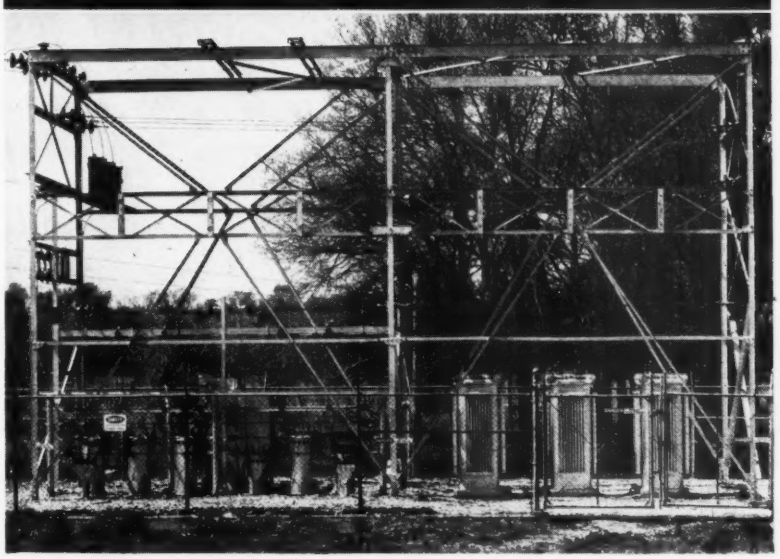
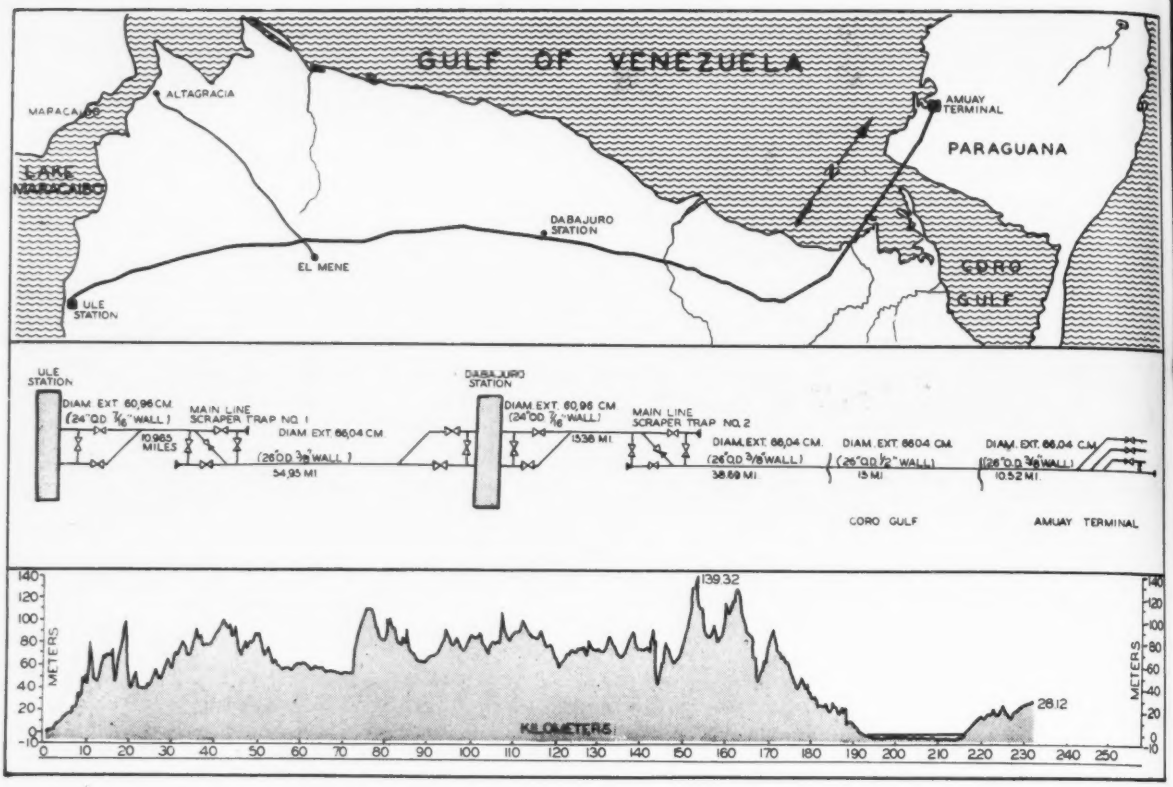




Upper: Baytown station pump room. In foreground are 400-hp. main-line units, motor operated valves in left background, control room in right background. Lower: Outdoor substation includes (right to left) power transformers, distribution transformers for "essential" lighting and auxiliary power, main outdoor breaker, and distribution transformers for "nonessential" lighting and auxiliary power



Map of Creole Petroleum Corp.'s oil pipe line from Ule station to Amuay terminal

CREOLE CONSTRUCTS A BIG-INCH LINE

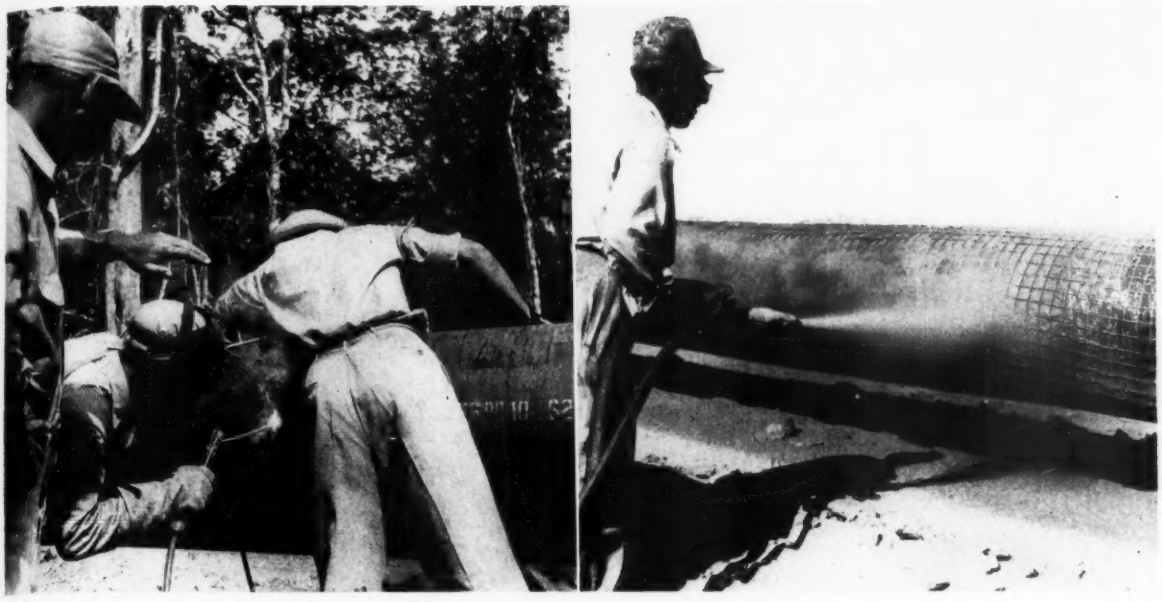
AT the termination of the recent war, Creole Petroleum Corp. definitely faced a transportation problem, in movement of crudes from the Bolivar coastal fields of Lake Maracaibo to world markets. All transportation, moving out such oil, was via small lake tanker vessels, having capacities ranging from approximately 22,000 to 37,500 bbl. These were necessary due to the restriction of the channel depth over the bar entering the Gulf of Venezuela, which is limited to a maximum depth of 19 ft.

Creole is operating a total of 38 small tankers, moving out its lake production, and of this total only 9 vessels are of a relatively modern class, being constructed in 1943 and 1945. The remainder of the lake fleet dates back as far as 1926, and hence are reaching an obsolete condition. Throughout the war no additions were made to the lake tanker fleet; some vessels were even transferred to active war theaters and were lost; others were lost in enemy submarine action off Aruba. Operation of the fleet at maximum capacity all through the war period restricted maintenance and repairs; so at the close of the war the major portion of such fleet of lake tankers was obsolete and in poor condition.

Today Creole has a production in Lake Maracaibo fields of approximately 480,000 bbl. per day, with a forecast by the end of 1951 or early 1952 of approximately 600,000 bbl. per day, and definitely faces the necessity of new and modern larger lake tankers, or construction of a major pipe line, to provide the necessary capacity outlet.

The mentioned nine modern vessels of the present fleet represent a daily average transportation of only approximately 225,000 bbl. It was therefore an urgent necessity that Creole add additional transportation of at least 300,000 bbl. per day. The net result was that engineering studies were initiated, which included a complete review of the cost of transportation by the existing lake tanker fleet, and estimated costs of transportation with new and modern lake tanker vessels: these were compared with a complete study of a major pipe-line system. These studies disclosed wide variance in cost of transportation, with as much as 300 per cent variance in the cost between the more modern vessels as compared with the old and obsolete ones.

The island of Aruba lies off the north coast of Venezuela. The major portion of Creole's Lake Maracaibo production is transported from terminals at La Salina and Lagunillas, a distance of approximately 200 miles,



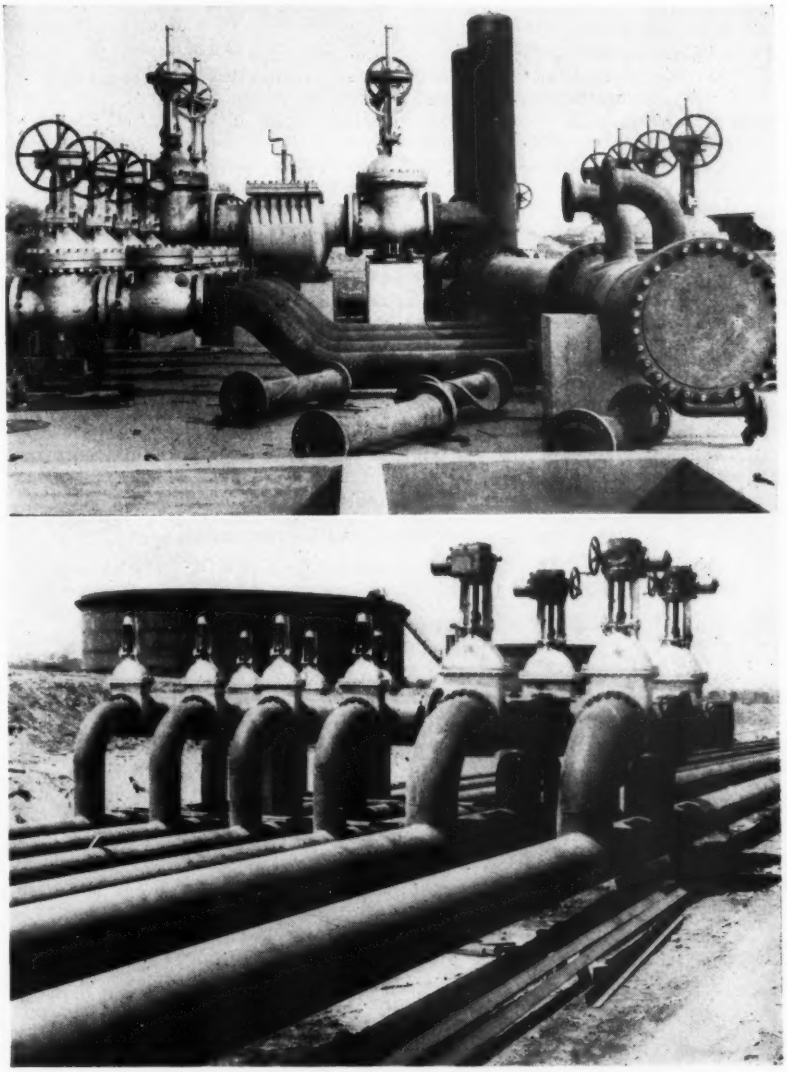
Left: Welding 26-in. o.d. pipe. Right: Gunite coating 26-in. o.d. pipe for submarine line

to Aruba, which is the site of one of the largest refineries now in operation in the world. The remainder of the production is moved to a deep-water terminal at Las Piedras, located on the Paraguana Peninsula, a distance of transportation of approximately 150 miles from the lake terminals.

At Las Piedras the crude is unloaded from lake tankers, and then reloaded into ocean tankers for movement into world markets. This terminal is not a modern facility, and the maximum loading rate of approximately 4,000 bbl. per hour represents high-cost operations. Therefore, in the over-all status of transportation, the question of a new terminal was definitely indicated as necessary.

Refinery to Be Served

The studies of a new big-inch pipeline-system outlet resulted in a decision to build a new large refinery of a 60,000-bbl.-per-day capacity, to be located at Amuay Bay, which is on the west coast of the Paraguana Peninsula, and immediately north of the existing terminal at Las Piedras. A magnificent harbor was obtainable at Amuay Bay, and with the refinery construction large dock facilities are included. To supply this new refinery at Amuay, the overland pipeline route afforded many advantages. The major cost of transportation today is involved in the high wage scales for labor. With the existing lake tanker fleet, the quantity transported per day per man amounted



Center: Ule pump station manifold. Bottom: Tank header. Note four 16-in. fill lines and two 24-in. suction lines, and 24-in. motor-operated valves

Construction scenes at Amuay Bay. View at left shows 1,575-hp. supercharged Cooper-Bessemer diesel engines each with 1,250-kw. generators. View at right is of the loading pump station

to approximately 417 bbl. In comparison, pipe-line transportation per man would be approximately 2,400 bbl. Material savings are also indicated in the items of fuel and maintenance, on the basis of cost per barrel transported.

A thorough investigation was also made of possible construction of new and modern design lake tankers, having a capacity of 60,000 bbl. per vessel. Due to chaotic conditions in Europe following the recent war, yards were not available for construction of such tankers, and investigations of cost of construction in yards in the United States disclosed an excessive cost due to inflated conditions. Even if decision was made to construct the new and modern lake tanker vessels, the number required was unobtainable in time to meet the required capacity outlet. One of the most critical items in the United States is that of steel, and on a per-barrel-transported basis, the pipe-line requirement was materially lower than that for the lake tanker vessels.

Creole has today in Lake Maracaibo fields production of crude oils of widely varying characteristics, ranging from low-gravity, high-viscosity fuel oil and asphalt stocks, to light and medium crudes for the refining of gasolines and diesel oils. Some of the production of very heavy crude oils, having gravity of as low as 12° A.P.I. and viscosities of 2,000 to 2,500 S.U.S. at normal temperatures, are not suitable for pipe-line transportation. Hence, continuation of the more modern lake tanker vessels, moving such heavy crudes, is fully competitive and will be continued. However, Creole's production of light and medium crudes of approximately 360,000 bbl. per day total, could be transported at minimum cost through a big-inch pipe line, and accomplish material savings.

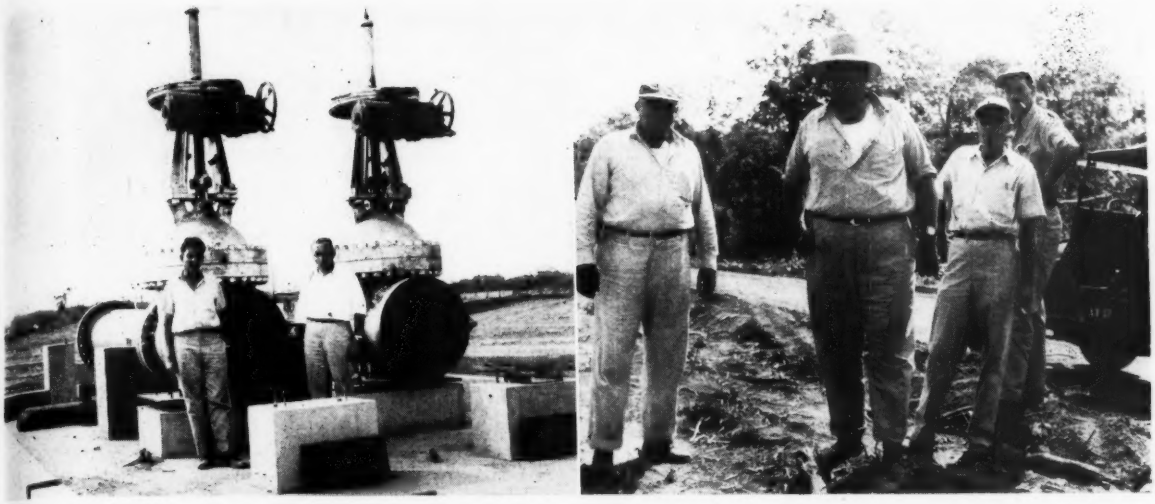
Based on the present average costs of the entire lake tanker fleet, the cost via a new big-inch pipe line, delivered into ocean tankers at a new terminal at Amuay Bay, was estimated at a rate of approximately 30 per cent of the present average cost. Decision was hence reached during the latter part of 1946 immediately to initiate plans for the construction of a new major pipe line, with an average daily throughput of 300,000 bbl. per day.

View of main line between Ule and Dabajuro stations

Route of Line

Engineering was completed in 1947, and orders placed for necessary materials. The pipe-line facility is now well along in construction. The line begins at Ule station, located on the eastern shore of Lake Maracaibo, and which is more or less centralized in the area of offshore production of light and medium crudes. The line then proceeds in a north-easterly direction and terminates at Amuay Bay, representing an over-all distance of approximately 145 miles. From the accompanying map it will be noted that this line includes a submarine crossing of the Gulf of Coro, which is one of the major difficulties in the construction of the project.

Design of the line is based on a throughput of 300,000 bbl. per day of Tia Juana medium crude, having



Left: Motor-operated 24-in. Series 600 gate valves at scraper inlet trap on outgoing line, at Ule station. Right: Members of Williams Brothers Co., pipe-line contractors on the Creole line. Shown are: A. M. Garber, general superintendent; David R. Williams, vice president; Bill New, engineer, and Jim Blakemore, spread superintendent

a viscosity of approximately 135 S.U.S. and a gravity of 26.8° A.P.I., at normal pumping temperatures of 90° F. One of the major difficulties in obtaining the materials was that of the required tonnage of pipe. The line, therefore, had to be designed on a basis of minimum steel usage for the desired throughput.

Decision was hence made to construct a combination 24 and 26-in. o.d. line, which with all stations and terminal piping would represent a total tonnage of 48,000 tons of line pipe. The definite trend in all pipe-line design is toward larger diameters, greater spacing between stations, reduction of pipe-wall thicknesses, and higher strength characteristics in the pipe. This trend is being followed in the present project, and only two pump stations are included: the initial at Ule, and the intermediate station near the town of Dabajuro.

The outgoing line from both Ule and Dabajuro includes a short section of 24-in. o.d. pipe, with 7/16-in. wall thickness. This pipe was purchased with slightly higher strength specifications than A.P.I. grade B pipe, i.e. with a minimum yield of 40,000 lb. and a minimum ultimate strength of 65,000 lb. From the end of the 24-in. o.d. line, construction is continued with 26-in. o.d., ⅜-in. wall, grade B A.P.I. line pipe. This pipe was purchased from National Tube Co. and in actuality all the pipe received was of materially higher characteristics than originally specified. The average yield on the pipe is 50,868 lb. and the average ultimate strength is 78,942 lb. The original design of the line was based on a maximum discharge pressure of 875 lb., which provided a safety factor of 1.665, on the yield.

However, the higher characteristics in the pipe actually received now provide with the same maximum discharge pressure a safety factor of 2.12, based on the yield. In view of the higher strength characteristics of the pipe, it is planned to possibly increase the maximum working pressure to 1,000 psi., which would provide a safety factor of about 1.86, based on the yield, and result in increasing the over-all average line throughput to 325,000 bbl. per day. The original engineering design of the line provided for a maximum stress of 24,000 lb., but in the event the maximum discharge pressures increase to 1,000 lb., a maximum stress of 27,000 lb. would result.

Sections of Project

The line is divided into two sections: Section No. 1 from Ule to Dabajuro is a distance of 65.6 miles. Starting from Ule with an elevation of 12 ft., the pump is uphill to Dabajuro at an elevation of 285 ft. Section No. 2 from Dabajuro to the terminal at Amuay Bay, a distance of approximately 79 miles, has an advantage head with a downhill gradient from 285 ft. at Dabajuro to one of 90 ft. at Amuay Bay. Section No. 2 includes the submarine crossing of the Gulf of Coro of 15.4 miles, which is being constructed of 26-in. o.d. line pipe, with ½-in. wall thickness, as a protection against expected severe salt-water corrosion.

Every possible modern protective feature against corrosion is being included in the construction of this submarine line. The protective coating includes three applications of Bitumastic XXH pipe-line coal-tar enamel, with two glass floss wrappers and one 15-lb. asbestos felt wrapper. On the outside of the multiple enamel coatings, a reinforced gunite concrete coating is applied, 1¼ in. thick. The completely coated pipe for this submarine line will weigh, including pipe and total coatings, 280.5 lb. per foot, and when submerged in water, will float, with an exposed surface of approximately 3½ in.

This submarine line is being pulled in from the laying yard on the Paraguana Peninsula, and directional piling clusters have been driven all the way across the Gulf of Coro, on approximately 300-ft. spacing. The line will be constructed in strings of approximately 3,500 ft. and will be pulled out from the peninsula in such lengths, and then anchored to the piling clusters, while additional sections are welded on. This process will continue until the entire length of 15.4 miles is a continuous floating line across the Gulf of Coro. Then, by pumping water into the pipe, it will settle to the bottom.

Soundings of the bottom of the Gulf of Coro disclose water depths varying from 3 to 19 ft., with the major portion of it at an average of 7 to 9 ft. One section of approximately 4½ miles includes the greatest depth of water. The bottom throughout the entire distance is sand and silt in nature, and no difficulty is expected in settling the line below bottom. Experience in Venezuela indicates a relatively brief life of enamel pipe-line protective coatings, with rapid destruction from marine animal life, such as toredos and barnacles. With the outside gunite concrete coating, plus burying the line below bottom, damage from such marine life is expected to be a minimum.

Cathodic protection will be installed on the shore at both ends of the submarine crossing, with a view to further increasing the service life.

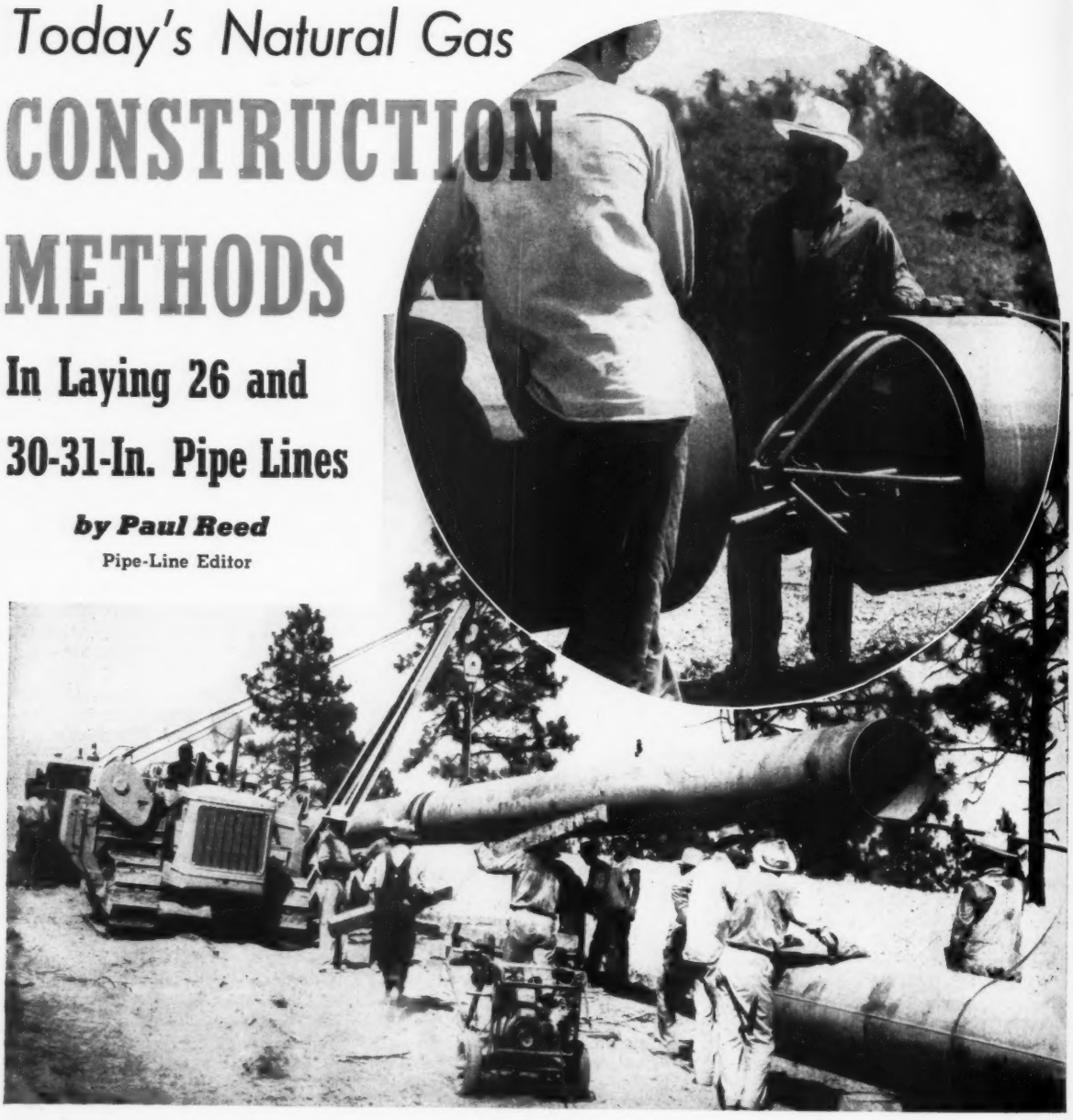
Past experience in Venezuela discloses a maximum service life of line is obtained when laid aboveground,

(Continued on page 278)

Today's Natural Gas CONSTRUCTION METHODS

In Laying 26 and 30-31-In. Pipe Lines

by Paul Reed
Pipe-Line Editor



Electric-operated internal lineup clamp in operation in laying 30-31-in. by Price-Bechtel for Tennessee Gas Transmission Co. Photo at top shows forward end of clamp in 60-ft. joint being added to line. Lower view shows portable engine-driven generator in foreground serving clamp traveling 3 ft. per second through interior of pipe to lineup position

OVERSHADOWING all other branches of the pipe-line industry is the program for expanding natural-gas-transmission facilities in the United States, involving more than 20,000 miles of line under construction in 1948 and planned for the future.

Modern methods for the laying of lines of the largest diameters are exemplified in projects now being built for increasing deliveries northward from the great reserves of the Southwest Texas and the Hugoton areas. This article presents modern and advanced operations of Price-Bechtel now laying 210 miles of 30 and 31-in. loop for Tennessee Gas Transmission Co. from El Campo, Tex., to the Natchitoches, La., area, and for Ray L. Smith & Sons Construction Co., Inc., now laying 180 miles of 26-in. from Ulysses to Hitchinson, Kans., for Cities Service Gas Co. On these projects the author observed during field trips such practices as denesting; double jointing, in yards and on the right-of-way; electric-operated internal line-up clamps; X-ray inspection of welding; coating and wrapping; machine bending, and utilization of radio communication between construction units in the field.

Practices described in this article were observed by the author in trips to contractors' operations at two projects where the largest-diameter pipe for natural-gas lines is being currently laid: the 210-mile, 30-31-in. contract for Tennessee Gas Transmission Co.; and the 180-mile, 26-in. for Cities Service Gas Co. near Dodge City, Kans.

The most prominent feature of the

Tennessee Gas Transmission Co. expansion is the current project for laying the 210-mile loop with 30-in. and 31-in. pipe originally destined for the 1,067-mile crude-oil trunk line being built by Trans-Arabian Pipe Line Co.

As a consequence of the postponement of granting certain export permits for Tapline, arrangements were made to divert this pipe to T.G.T. during the period of delay. Because this pipe originally intended for Arabia is being laid by a contractor organization with executives in the field who have been actively engaged earlier this year in Saudi Arabian construction, this project has been referred to as "Little Arabia." Texas heat and dust do not diminish the Arabian atmosphere.

30-In. Construction

This project of T.G.T. is the first 30-in. line for petroleum or natural-gas service to be laid east of the Rockies. The first 30-in. for the United States pipe-line industry was laid last year for Southern California Gas Co.'s 214-mile Blythe-Los Angeles line.

These lines together with the Trans-Arabian line represent the initial steps toward the coming era which will be using pipe of 30 in. and larger-diameter pipe on a large scale for the great movements of crude oil and natural gas required for meeting future demands.

The 204-mile, 30-31-in. loop is part of the so-called second line of T.G.T. constructed in 1947 and 1948 consisting of 661 miles of 20, 24, 26, 30, and 31-in. pipe laid from station No. 1 near Victoria, Tex., to Cornwell, W. Va.

A third line of T.G.T. is to be built in 1949 and 1950 from station Zero at Agua Dulce, Tex., to (Broadrun)

Top: Largest type of tractor with 30-bbl. kettle equipped with mechanical agitator near El Campo, Tex. Center: X-ray equipment and portable dark room mounted on half-track truck near Jasper, Tex. Bottom: In foreground is grease truck, with special reel equipment for hose, serving dope-gang equipment near El Campo

1948 MAJOR NATURAL GAS *Pipe Line Projects*

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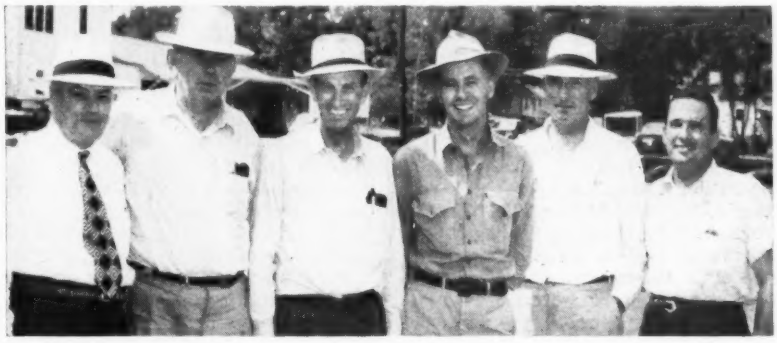
Major 1948 Projects

CONSTRUCTING—PLANNED

Key	Status	Company—	Location
1	Planned	Atlantic Gulf Gas Co. (United Gas Pipe Line Co.)	Alabama—Florida—Georgia—South Carolina
2	Planned	Atlantic Seaboard and Virginia Gas Transmission Co.	Clendenin, W. Va.—Rockville, Md.
3	Under way	Cities Service Gas Co.	Ulysses, Kans.—Kansas City, Mo.
4	Planned	Commonwealth Natural Gas Corp.	West Bend, Ky.—Norfolk, Va.
5	Planned	El Paso Natural Gas Co.	Eunice, N. M.—Blythe, Calif.
6	Under way	El Paso Natural Gas Co.	Eunice, N. M.—Dumas, Tex.
7	Planned	Gulf Coast Northern Gas Co.	La Gloria — Seeligson fields, Tex.—Geneseo, Ill.
8	Under way	Michigan-Wisconsin Pipe Line Co. and Austin Field Pipe Line Co.	Hansford County, Tex.—Milwaukee, Wis.—Big Rapids, Mich.—Detroit
9	Planned	Pacific Gas & Electric Co.	Needles, Calif.—San Francisco
10	Planned	Piedmont Natural Gas Corp.	Tex. and S. W. La.—Danville, Va.
11	Planned	Panhandle Eastern Pipe Line Co.	Looping of Texas-Detroit system
12	Planned	San Juan Pipe Line Co.	San Juan Basin, N. M.—Needles, Calif.
13	Planned	Southern Natural Gas Co.	Gwinville, Miss—Atlanta, Ga.
14	Under way	Tennessee Gas Transmission Co.	San Salvador — Agua Dulce, Tex.—Cornwell, Va.
15	Planned	Tennessee Gas Transmission Co.	Burnaugh, Ky.—Buffalo, N.Y.—Boston
16	Planned	Texas Eastern Transmission Corp.	Texas—Pittsburgh, Pa.
17	Planned	Texas Gas Transmission Co.	E. Texas—Middletown, Ohio
18	Planned	Transcontinental Pipe Line Co.	Mercedes, Tex.—New York
19	Planned	Trunkline Gas Supply Co.	Wharton, Tex.—Keokuk, Iowa
20	Planned	Northwest Natural Gas Co.	Alberta, Canada, fields to Seattle, Wash.—Portland, Ore.—Vancouver, B. C.

Grover C. Swartz, Crutcher-Rolfs-Cummings; R. A. Conyes, president, Conyes Construction Co. and vice president, Bechtel Corp., in charge of Bechtel-Conyes joint venture construction operations; Ray Hamilton, engineer, Bechtel Corp.; S. D. Bechtel, Jr., engineer, Bechtel Corp.; Paul Reed, pipe-line editor, The Oil and Gas Journal; Jack Walker, Crutcher-Rolfs-Cummings at Jasper, Tex., headquarters of Bechtel Corp. where Conyes is supervising spread operations



Cornwell, which will total 992 miles including 760 miles of 30-in., 143 miles of 26-in., and 89 miles of 24-in.

The original Agua Dulce-Cornwell 1,265-mile, 24-in. line was built in 1944.

Construction operations of Tennessee Gas Transmission Co. are directed by J. P. Bristow, vice president, and Charles S. Coates, superintendent of construction and operation.

Contract for construction of this 210-mile loop has been awarded to Price-Bechtel, a joint venture of Bechtel Corp. and H. C. Price Co. James P. Neill, vice president, H. C. Price Co., is acting as general manager, with William von Phul, Jr., engineer, Bechtel Corp., as assistant manager. The work is being done by three spreads: spread A (Price), working in the El Campo-Wharton, Texas, area is supervised by J. E. Ellis; spread B (Bechtel) near Jasper, Tex., is directed by R. A. Conyes. Spread C (Price) in the Natchitoches-Many, La., area is under Abe Reutzel.

Experience in the laying of these lines indicates that 30-in. pipe is about as large as practicable for the key units of present pipe-line-spread equipment. For lines with diameters larger than 30 in., it is predicted that there will be a need for larger ditching machines and tractors than those used up to now in pipe-line-construction spreads.

At each of the three Price-Bechtel spreads, the pipe is double jointed in a yard near the railhead so as to weld two 30-ft. joints to form a 60-ft. joint. Pipe is half 30-in. and half 31-in. with ¼-in. and ⅜-in. walls, varying in weight from 79 to 121 lb. per foot. A division of the 30 and 31-in. pipe has been arranged so that pipe of each diameter will be segregated into sections 5 to 20 miles in length at locations planned in advance along the route of the project. Double jointing in the yards is done by position welding with internal line-up clamp.

At the beginning of the job, spread B at Jasper received nested pipe with 30-in. inside 31-in. Nesting had been done at the Consolidated Steel Corp. mill at Los Angeles in connection

Denesting 30-in. from 31-in. at Jasper yard. Early shipments arrived with 30-in. inside 31-in. to conform with Trans-Arabian Pipe Line Co. program from which this pipe was diverted for Tennessee Gas Transmission project

Above: Stovepiping with 80-ft. 26-in. joints formed by double jointing 40-ft. joints on the right-of-way. Left: Bending machine which operates by bending against springs without template; automatic opening and closing of shoe; pivot-mounted bending and holding shoes are self-aligning. Both views are of Ray L. Smith & Sons Co., Inc., operations on Cities Service Gas Co. line

with the practice followed by Trans-Arabian Pipe Line Co. to conserve ocean shipping space of cargo vessels. This shipment of nested pipe consigned to T.G.T. came by boat to Beaumont where it was transshipped overland to Jasper. The handling and storing of 16 miles of this large-diameter pipe represented a major yard operation. Denesting operations were carried on until August 20. All of the remainder of the pipe for the Jasper spread as well as all of the pipe for the other spreads comes in single unnested joints by rail from California.

The denesting procedure at the Jasper yard was handled by pulling a 30-in. joint out of a 31-in. joint by means of a winch line fastened to a special frame inserted in the end of the 30-in. joint. The 30-in. joint being removed slides along rollers to a place where it is rolled on skids arranged so that 30-in. and 31-in. joints are racked separately. While at the Jasper yard, the author had a chance to observe that denesting was accomplished quickly and smoothly.

Electric-operated line-up clamps are used on the right-of-way as well as in the yards by all spreads on the T.G.T. loop contracted by Price-Bechtel. A small portable electric generator is trundled along with the pipe gang to operate the line-up clamp. Because of the tendency of large-diameter pipe to become egg shaped, more power and speed are being required for line-up operations in order that welding may proceed at the fast pace desired for spread operations.

Welding is inspected by X-ray in conformance with the T.G.T. policy applying to all its pipe-line-construction work. T.G.T. is using X-ray inspection more extensively than any other pipe-line company.

The service contracted by T.G.T. with Industrial X-ray Engineers for inspection of all its new pipe lines, differs from that employed last year in the laying of the Blythe-Los Angeles 214-mile, 30-in. line where a capsule of radium was inserted through a hole in the pipe. Industrial X-ray Engineers run an X-ray machine through the pipe, thus avoiding the need for perforating. By this method an exposure can be made in a few minutes on a strip of film strapped around the pipe over the weld. An X-ray service engineer develops film in a laboratory mounted on a half-track which travels along the right-of-way. Much sound welding is saved by this procedure. It is possible to correct numerous cases of faulty welding on the line. Savings in expense of cutting out questionable welding and the attainment of a high quality of welding generally are reported as amply justifying the X-ray inspection.

Egging Tendencies Reduced

Double cradling of pipe handled by the dope gang has reduced egging tendencies enough to facilitate coating operations. Rubber rollers on the cleaning and priming machine eliminated scarring of the pipe. The pipe is protected by coal-tar-enamel coating and glass mat.

At the operations of the Price spread near El Campo, the author had an opportunity to observe the effective provision for greasing construction equipment which is possible with a special type of truck with reels for grease hoses.

Efficiency of the Price-Bechtel spreads had been increased by radio communication between the superintendents, foremen, utility welders, and the field office. Because of the great expense of modern big-inch spreads, savings of time effected by quick communication soon pay out the cost of radio facilities.

In Kansas the operations of Ray L. Smith were observed near Dodge City on the 405-mile, 26-in. line from Ulysses, Kans., to Kansas City, Mo., which is being built in 1948 and 1949.

Work on the main-line contract of 180 miles of 26-in. began July 11. In addition, the contractor laid several miles of 26-in. and 6,000 ft. of 16-in. in the vicinity of the Ulysses compressor station.

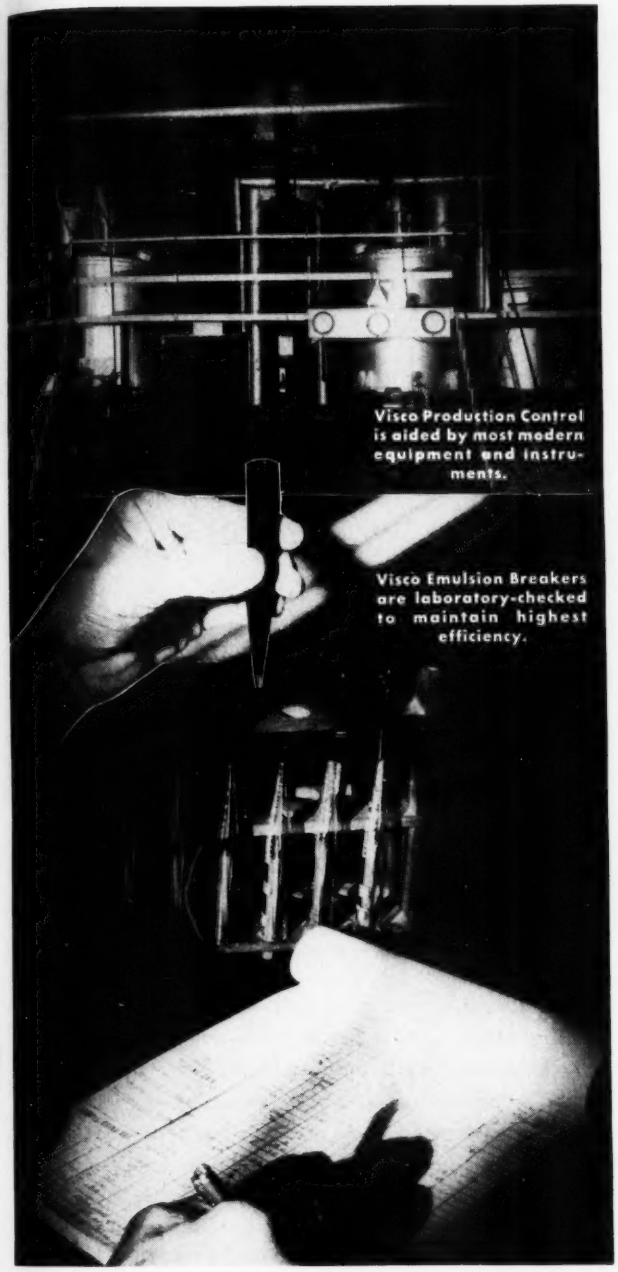
Prior to the Ray L. Smith construction, pipe laying was under way for this project by Midwestern Constructors, Inc., for 50 miles of 26-in. section between Ottawa, Kans., and Kansas City, completed this summer.

The project is being built under the direction of George H. Baird, vice president, and C. D. Rogers, general superintendent. The chief inspector is M. O. Thomas. The contractor's operations are supervised by Joe Work, general superintendent, and William Frost, spread superintendent for Ray L. Smith.

Double jointing on the right-of-way has produced results on this project which have been satisfactory to the contractor who has employed this practice on other projects.

This double jointing is done by a gang which works in close conjunction with the bending gang just ahead of the pipe gang. In this double jointing, two 40-ft. joints are position welded to form an 80-ft. joint which is added to the line by the pipe gang.

Lining up for the double jointing as well as for the pipe gang is done by hand-operated line-up clamps. In the operations of the three gangs at the front end, the bending gang uses an RD-7 tractor, the double-jointing gang an RD-4, and the pipe gang an RD-7.



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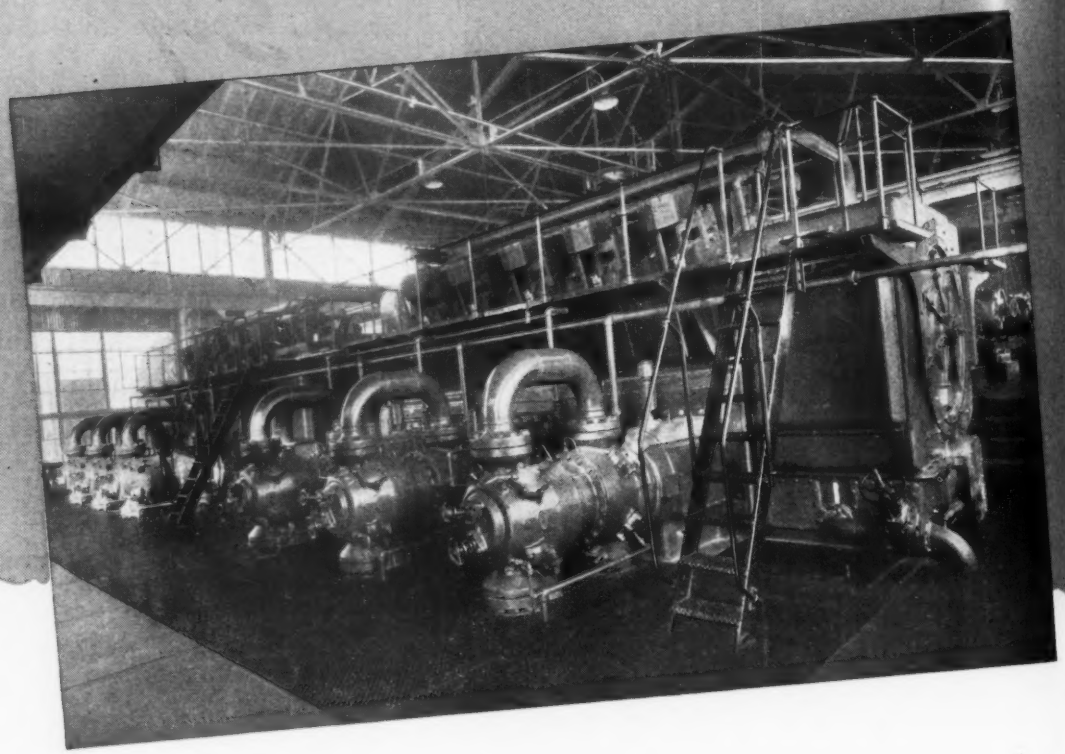


COOPER-BESSEMER

V-angles

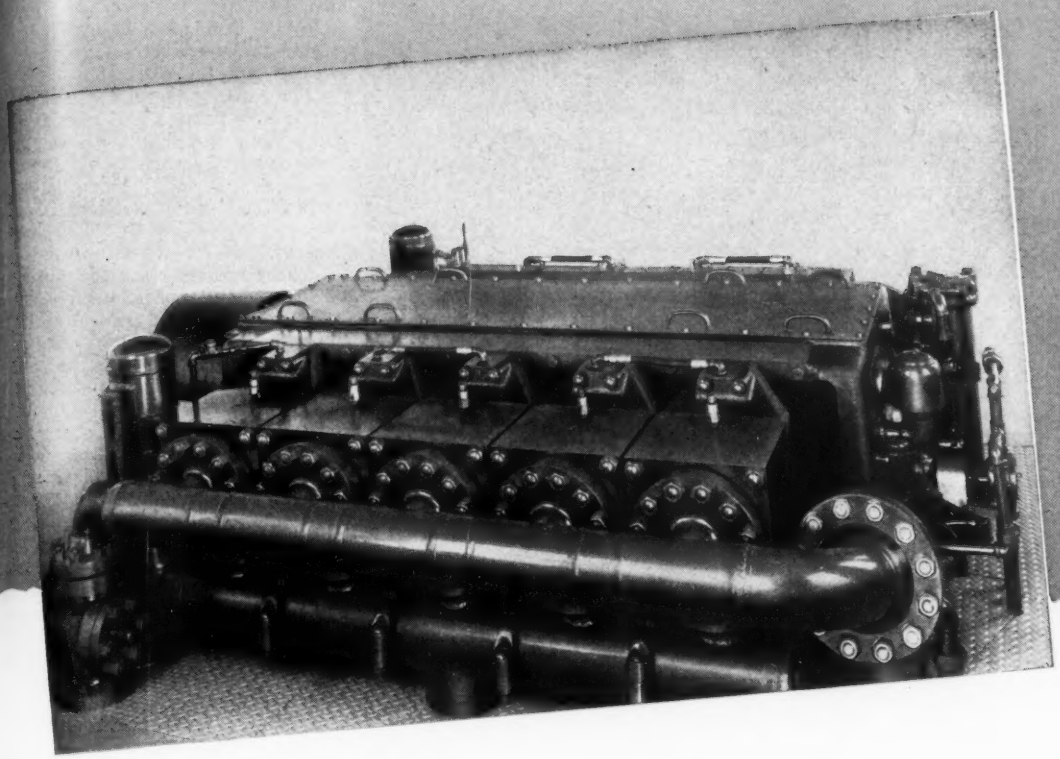
for Gas Transmission

Shown above is one of scores of compressor stations where modern Cooper-Bessemer V-angles have proved their cost-reducing advantages. They have a great deal to offer. You save on the cost of installation, piping and housing because of their extreme compactness. Their high over-all operating efficiency saves you money on fuel and lube oil consumption. Sensitive, highly responsive, they are ideal for time-saving automatic control. Their long life, high availability and low-cost maintenance are matters of record — the kind of performance that would always be a credit to your judgment in the selection of compressor equipment. Cooper-Bessemer V-angles are now available in three fully-proved types, the GMX, GMV, and GMW, from 200 to 2,400 compressor horsepower per unit.

Compressors · Pumps · Engines

New York Washington Bradford, Pa. Parkersburg, W. Va. San Francisco, Cal. Seattle, Wash. Houston,

in pipe line service!



COOPER-BESSEMER

Twin-Line

Liquid Pumps

for oil line pumping

If you are not fully acquainted with the unique advantages introduced by these radically different pumps, it might pay you to get the whole story! For example, Cooper-Bessemer pumps offer mechanical efficiencies exceeding 92%, and volumetric efficiencies from 93 to 96%. Compared with other reciprocating pumps they set a new low in over-all weight and space to cut the cost of installation and housing. Their normal speed of 400 rpm permits the simplicity and full economy of a direct-connected prime mover. Their extreme flexibility meets widely varying requirements economically. Greatly simplified, low-cost maintenance is still another outstanding feature. A new bulletin fully explaining these and other money-saving advantages is now yours for the asking.

by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

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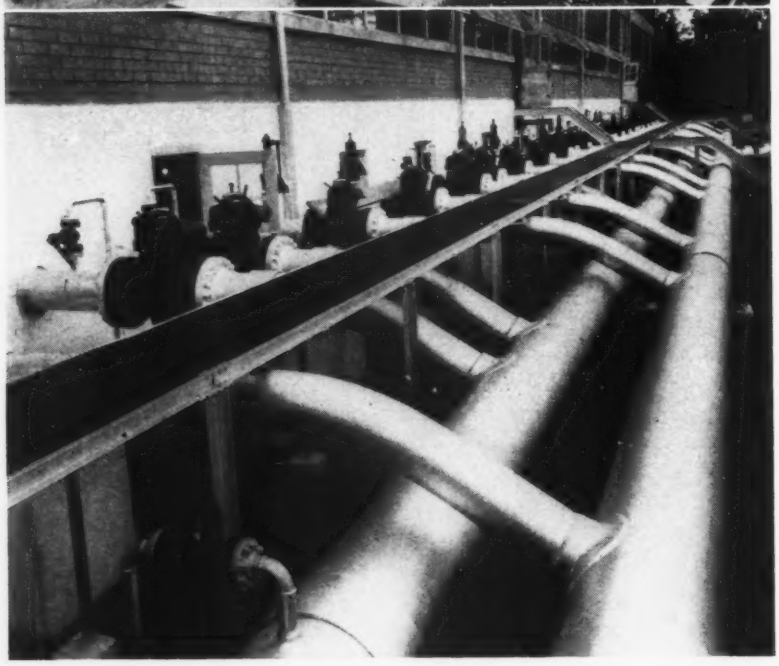


Upper: Pouring foundation for Cities Service Gas Co. compressor station at Ulysses, Kans. to serve new line to Kansas City. Lower: Manifold at Fostoria, Tex., compressor station of Tennessee Gas Transmission Co. between El Campo and Jasper

To indicate comparative results, output figures have been reported for periods when double jointing has been used and when it has not been used. During the first month on this project the lowest daily output under good working conditions was 8,500 ft. of welded pipe when double jointing was used. In contrast with this, the record of several days has been cited when double jointing was discontinued temporarily and output was lowered to an average of 7,400 ft. daily.

While watching the pipe gang, the author noted the time taken to add several 80-ft. joints. It took approximately 3 1/5 minutes from the beginning of line up, through the running of the stringer bead to the start of lining up the next 80-ft. joint.

The record for operations on August 12 was given as an example of a 10,000-ft. day: ditched 10,700 ft.; firing line 9,700 ft.; cleaning, priming and painting, 12,800 ft.; laid 10,000 ft.; backfilled 10,000 ft., clean up 10,000 ft.

Welding is done with four continuous beads and a strip bead. The stringer bead is made with a No. 85 electrode. As soon as possible after the weld cools, immediately following buffing, a hot pass is applied with a No. 5 electrode; this same type of electrode is used for the strip bead, at the edges of the bevel, as well as for the filler bead and the finish bead.

26 Welders in Spread

There have been approximately 26 welders in the spread including two stringer bead welders and two hot-pass welders in the double-jointing gang; two stringer bead and two hot-pass welders in the pipe gang; 15 welders on the firing line; and 3 utility welders.

The main line has $\frac{5}{16}$-in. wall; laterals ¼-in. wall. Pipe from Glavin Junction, near Olathe, Kans., to Kansas City, has ¼-in. wall.

In the spring months before the 405-mile, 26-in. line started, Cities Service Gas Co. laid two 20-in. river crossings with its own crews supervised by M. O. Thomas. These crossings involved 2 miles of laying across the Arkansas River and Cow Creek, ¾ mile east of the Arkansas River. In doing this the well-point method of dewatering the river sand was employed. The two 20-in., $\frac{3}{8}$-in.-wall lines for these crossings were laid 150 ft. apart.

Main-line gates are installed at 10 to 12-mile intervals. A pig is run before tying in the gates. Two sections are tested together. Later a pressure test will be applied on a 60-mile stretch in three sections. Pressure testing is done with 350-400 psi. gas transmitted directly from the wells.

There are six slack loops per mile. Each slack loop is suspended over the ditch by two slings until lowered in the ditch at day break.

This 405-mile, 26-in. line will be served by a single compressor station at Ulysses, Kans., where construction is now in progress for the early installation of eleven 26-by-38, 125-r.p.m. 1,600-hp. horizontal compressor units. Eventually 8 more units are to be added to bring the total to 19 units. Maximum discharge pressure is to be 950 psi.

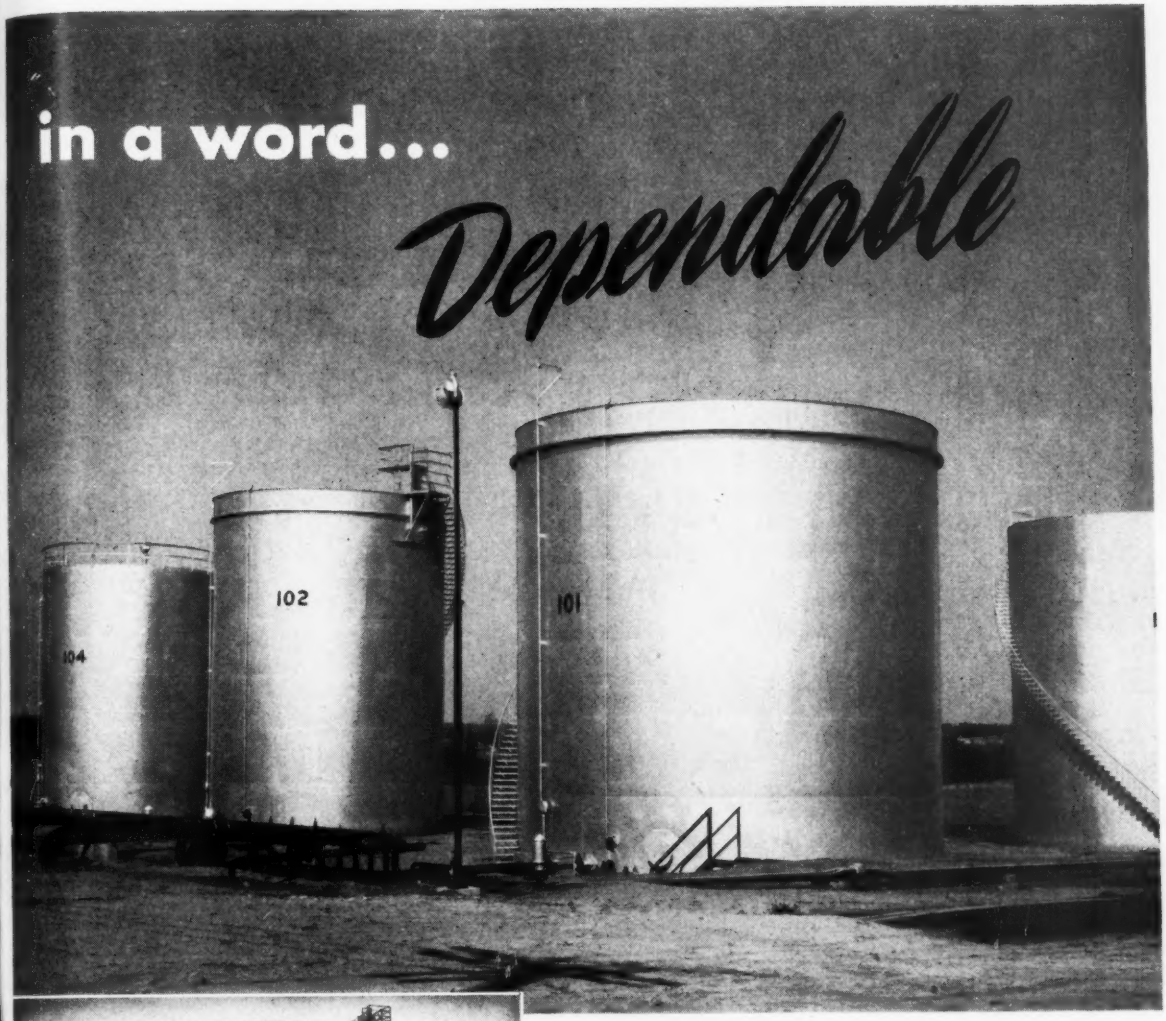
At road crossings, 30-in. casing is installed with 4-in. vents. Spacer-insulators are installed between pipe and casing; ends are closed with bushings. Welds on 26-in. pipe within the casing are all protected by the reinforcing sleeve. The outside surface of the casing is painted.

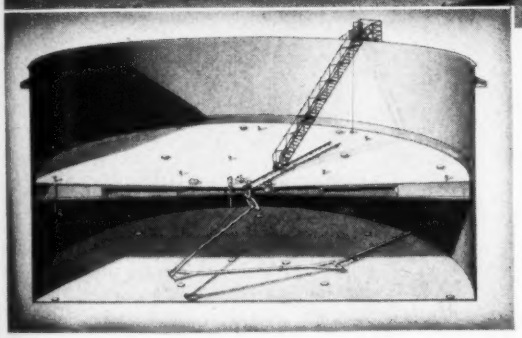
At the end of the first month of construction there were 260 men working in the spread. Work on the ditch and right-of-way was done by two large ditchers, a back hoe, clam, two backfillers, and three dozers. The lowering-in gang had four RD-7 tractors. There were two tow tractors. A rubber-mounted tow tractor moved welding machines for the firing line.

The pipe is protected by coal-tar enamel wrapped with asbestos felt. The dope gang is served by dope kettles of three different sizes and manufacturers: two 30-bbl.; two 15-bbl.; and three 10-bbl. The advantages of the most modern-type kettles with mechanical agitation have been demonstrated in the prevention of coking and improvement of coating quality.

Bending is done by a power-operated bending machine with a maximum of 2° per wrinkle and a minimum spacing between wrinkles of 28 in.

An engineer surveys ahead of the ditching machine to determine how the pipe will be bent. Stakes are marked to show degree of bends and depth of ditch. Copies of the engineer's report go to the ditching machine operators and the bending gang foreman.





Cutaway view showing the construction of a Horton Double-Deck Floating Roof as installed in a butt-welded tank. The large view at the top shows two tanks (Nos. 101 and 102) equipped with Horton Double-Deck Floating Roofs. They are located at the Gulf Oil Corporation pipe line terminal, Spartanburg, S. C., and are used to handle gasoline.

THE HORTON DOUBLE-DECK FLOATING ROOF

The Horton Double-Deck Floating Roof is widely used in the petroleum industry because it can be depended upon to eliminate filling loss, to reduce evaporation loss and fire hazard, to lower maintenance costs, and to require only normal maintenance. Its dependability has helped make it *first choice* for new or existing flat-bottom tanks storing volatile liquids that do not boil at normal temperatures. The Horton Double-Deck Roof quickly pays for itself when used on working tanks, tanks in blending service, and tanks storing sour crude or other corrosive products. Complete details are available on request. Write our nearest office for Bulletin B.

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Cleveland, 15.....2204 Guildhall Bldg.
Detroit, 26.....1514 Lafayette Bldg.
Havana.....402 Abreu Bldg.
Houston, 2.....2119 National Standard Bldg.
Los Angeles, 14.....1423 Wm. Fox Bldg.
New York, 6.....3347-165 Broadway Bldg.
Philadelphia, 3.....1615-1700 Walnut Street Bldg.
Salt Lake City, 1..1525 First Security Bank Bldg.
San Francisco, 11..1254-22 Battery Street Bldg.
Seattle, 1.....1325 Stuart Bldg.
Tulsa, 3.....1606 Hunt Bldg.

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General Pipe Line Constructors

Laying first 30" pipe in the Mid-Continent area, for Tennessee Gas Transmission Co., on a 210-mile loop from El Campo to western Louisiana.

H. C. PRICE CO.

Bartlesville, Okla. Los Angeles, California

Pipe-Line Movement of Natural Gas in 1948 Will Break All Previous Records

by John C. Casper

MORE natural gas will be moved through pipe lines in 1948 than in any year in the past and yet the line capacity will not be sufficient to supply the demands during the coming winter. These greatly increased current requirements and the outlook for continuing high demands justify the postwar construction program for the natural-gas pipe lines.

It is noteworthy that long-distance lines account for a major portion of the mileage in this construction program. The total miles of line authorized by the Federal Power Commission from February 7, 1942, to June 30, 1947, amounted to 11,988 miles including 8,363 miles authorized during the last 24 months of the period. The size of the program is indicated by the total of 8,468 miles approved in the 12-month period ending with June of this year.

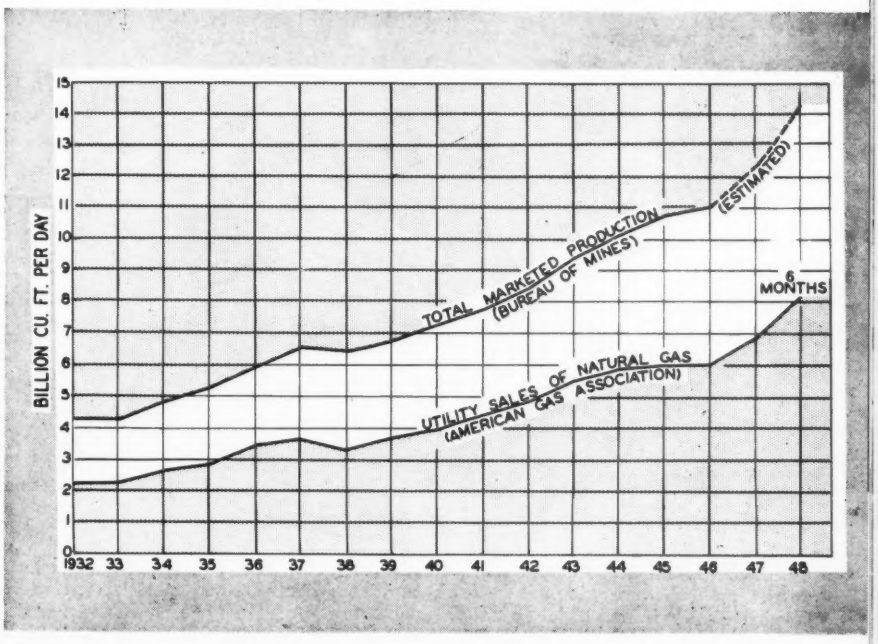
In addition to the authorized mileage, applications for approval by FPC included more miles of line than were authorized in the last 12 months. Since the date of the last commission tabulation, June 30, several other projects have been announced. These include a 26-in. line from the Gulf Coast to the Chicago area and a 20-in. line beginning in the upper Gulf Coast gas fields, extending through five southern states and terminating at Danville, Va.

This phenomenal construction program is influenced by two principal demand factors. First, the sharp upward trend in total demand for natural gas is an indication of good markets for several years. Second, a large part of the increased demand is in an area located at least 1,000 miles from our major reserves in the Southwest.

The relative growth in the use of natural gas has been much greater than that of either coal or oil. Marketed production of natural gas in 1947 had increased 137 per cent over production in 1929, compared with an increase of 84 per cent in crude production and 16 per cent in the production of bituminous coal. Anthracite production dropped 23 per cent in the same period. Sales of natural gas by utilities have almost doubled since 1941, while domestic demand for petroleum and petroleum products gained about 43 per cent.

One of the primary reasons for the relative growth of natural-gas consumption is the fact that gas prices are now less than they were in the early thirties while the prices of other fuels have increased. According to Bureau of Labor Statistics, the wholesale price index for gas, based on 1926 as 100, was 101.3 in 1932 and had dropped to 88.7 by the end of March of this year or a decrease of 12.4 per cent. The index for anthracite coal moved up from 88.4 in 1932 to 124.6 at the end of last March for an increase of 41.0 per cent, while the index for bituminous coal gained 117.0 per cent for the same period. Changes in retail prices have been in about the same proportion. In other words, if gas in a certain area could compete in price with other fuels in 1932, it is in a more favorable position today. In other areas where gas could not compete with other fuels in 1932, the price increases for other fuels have placed gas in the fuel market.

Trends in Natural-Gas Demand 1932-48



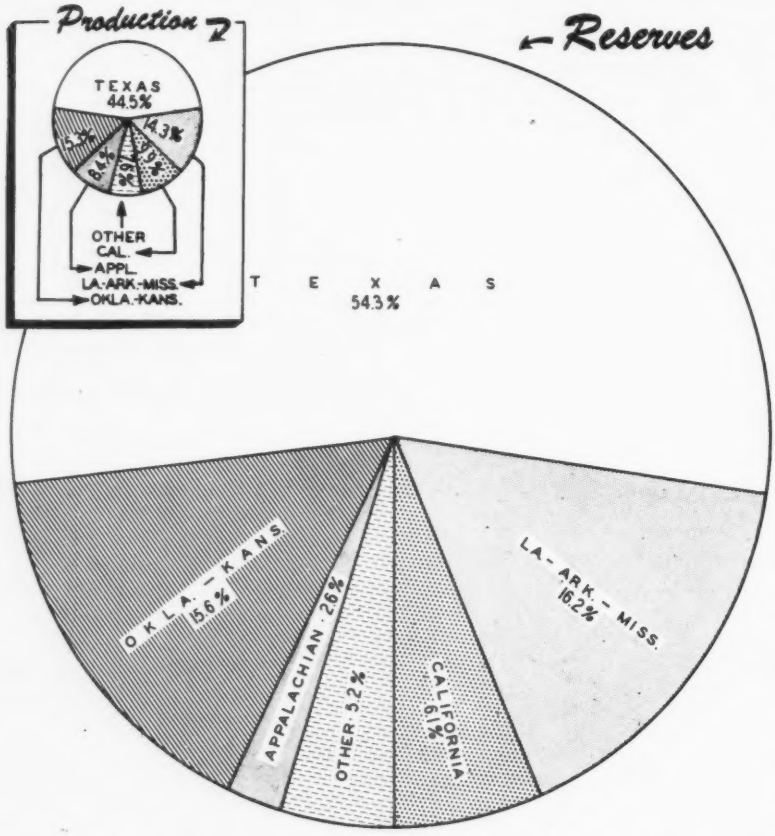
The upward trend in domestic consumption of natural gas can be expected to continue for several years. Production of gas-type water heaters increased 44 per cent in 1947 over 1946. Gas-range production was up 40 per cent in 1947 and in the first 4 months of 1948 it was up another 22 per cent over the same period in 1947. Installations of gas burners for home heating have been limited by the winter-time shortage of gas in the high-demand areas, but will increase rapidly as soon as the fuel is available.

Trend Towards Conversions

Another factor in the growth of natural-gas demand is the trend toward conversions from manufactured to natural gas. Many gas companies on the Eastern Seaboard, now serving their customers with manufactured gas, have about reached plant and distribution-line capacities. They are faced with the problem of expanding their facilities at a time when costs are high and material is scarce. If they can purchase natural gas, they can solve the problem without additional construction since the higher heat value of natural gas will enable them to serve about twice as many customers through the same distribution mains.

Since a big part of the potential demand for gas is in an area far re-

Comparison of Gas Reserves With Gas Production



moved from cur natural-gas fields, the long-distance gas line becomes a part of the demand picture. The best potential markets for gas are in the areas with high population densities. If we consider the northeastern part of the United States, roughly the area east of the Mississippi River and north of Tennessee and North Carolina, we have a section with more people per square mile than in any other large area of the country. This region has about two-thirds of the total urban population but only 17.6 per cent of our land area. This section with its high percentage of city and town residents produced only 10 per cent of our natural gas in 1947, and according to estimates made by the American Gas Association, had only 2.8 per cent of total natural gas reserves at the end of 1947.

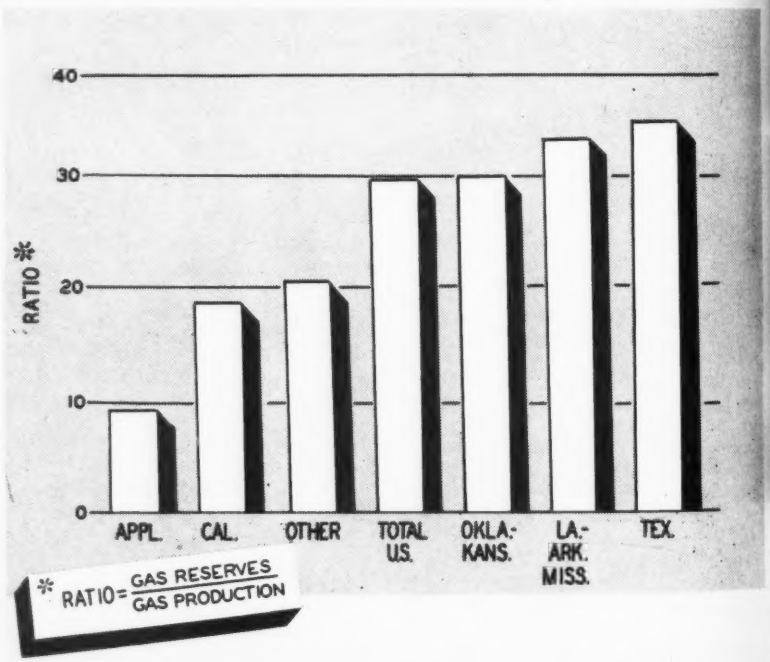
Our major reserves are in the Mid-Continent, South, and Southwest districts. Oklahoma and Kansas combined have 15.6 per cent of gas reserves; Louisiana, Arkansas, and Mississippi have reserves that equal 16.2 per cent of the total; and Texas alone has more than half (54.3 per cent) of the proved recoverable natural-gas reserves of the country.

Most of the mileage in the postwar construction program for gas lines is taken up by the long-distance lines connecting the high-reserve areas in the Southwest with the high-demand areas in the Northeast. Before 1930, there were no lines connecting these two areas and even at the end of the last war the Southwest-Northeast line capacity was small. In 1946, the last year for which detailed figures are available, the Bureau of Mines reported total shipments into the northeastern area amounting to only [illegible] M.M.c.f. per day or about 7.7 per cent of total marketed production for the country.

Something of the magnitude of the current program can be shown by comparing capacities of new and proposed lines with the total movement in 1946. The present capacity of the converted "Big and Little Inch" lines is about 500 M.M.c.f. per day and the expansion program will bring the total to over 900 M.M.c.f. per day. The recently authorized line to be constructed by Transcontinental Gas Pipe Line Co. will have a capacity of about 325 M.M.c.f. per day. Tennessee Gas Transmission Co. has a construction program that will increase the capacity of that system to about 1,000 M.M.c.f. per day. These are just a few of the lines that will be built but completion dates for some of the projects will be well after 1950. Only a small part of the planned work has been completed. The delay is due principally to the shortage of steel.

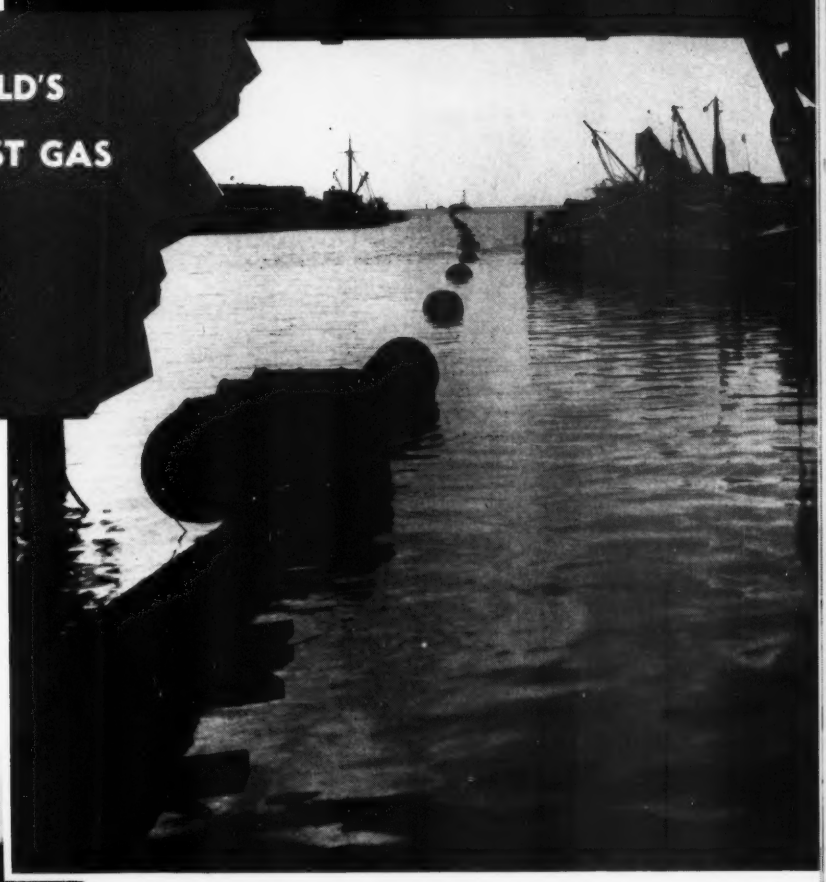
Natural-gas reserves at the end of 1947 were about 30 times net production for the year. If we are to maintain this ratio of reserves to production, we need to find about 25 trillion cubic feet of gas this year from either extensions and revisions in old fields or from discoveries of new pools and pays.

Ratio of Gas Reserves to Production, by Districts



LAUNCHING THE WORLD'S LONGEST AND LARGEST GAS TRANSMISSION LINE

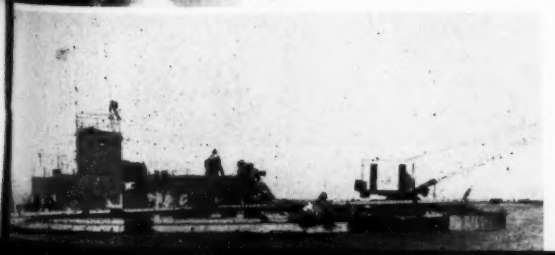
ever laid to an off-shore gas field . . .



Launching ways where the pipe was made up into 5000′ sections and floated out to sea.

Joining two 5000′ sections over water in the 13-mile line.

Here is one of Continental's specially equipped marine pipe line boats from which off-shore work is done.



Stretching 13 miles out through shallow and deep water into Matagorda Bay, the 8 5/8 inch Lavaca Pipe Line project marks a major milestone in pipe line construction.

And like any other pioneering project, it presented new construction problems that were readily solved by Continental Construction Company's specialists in off-shore pipe line work.

For one thing, the line was made up on land into 5000′ sections, launched and floated into position, then welded at sea.

Continental Construction Company . . . first to specialize in off-shore pipe line work . . . is completely equipped for the rapidly expanding off-shore pipe line work. We are equipped with a large staff of capable and experienced pipe line men, with the proper marine equipment, with special "know-how" in marine pipe line work.

With increased off-shore drilling activity, more and more off-shore pipe line problems will have to be solved in the future. We have proved in our work for other operators that we can be of help in solving your off-shore pipe line problems. We will appreciate your inquiries.

CONTINENTAL CONSTRUCTION CO.

PORT LAVACA, TEXAS

FIRST TO SPECIALIZE IN *off-shore* PIPE LINE CONSTRUCTION

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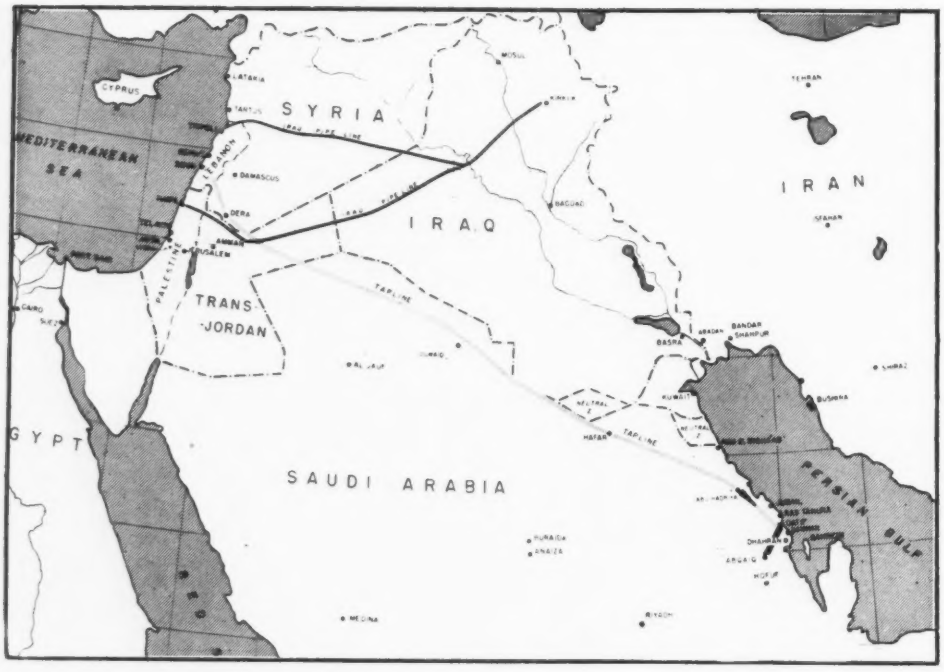
Photographs by B. I. Lempert

TAPLINE-

BIGGEST INCH CARRIER

Above: Preparation of the Abqaiq-Qatif right-of-way entailed the moving of large quantities of sand by bulldozers, scrapers and draglines. These two tractors are in the midst of cutting down a sizable sand dune



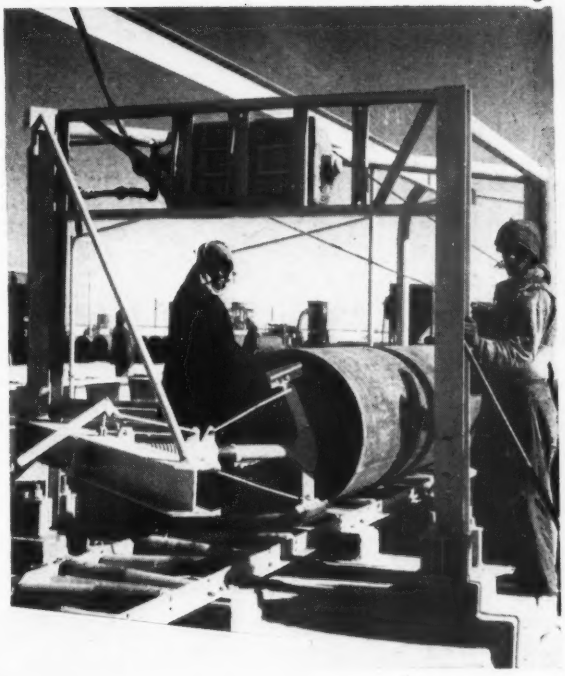
Above: Ras el Misha'ab, which until the summer of 1947 was nothing but an expanse of wind-blown sand at the edge of the Persian Gulf, became a miniature city a few months later. It is the main port and supply depot for the construction of the easterly two-thirds of the Trans-Arabian pipe line

Opposite page: At Ras el Misha'ab, while an Arab operates the suction hose that retrieves flux for reuse, one of the four automatic welding machines equipped with internal hydraulic line-up clamps triple joints the 30 and 31-in. pipe before it is hauled to the right-of-way

Left: Map of area, showing route of new pipe line

Super Problem *in* Logistics

by Richard Finnie*



Above: The jig shown here denests the joints of 30 and 31-in. pipe after they have been brought ashore at Ras el Misha'ab.

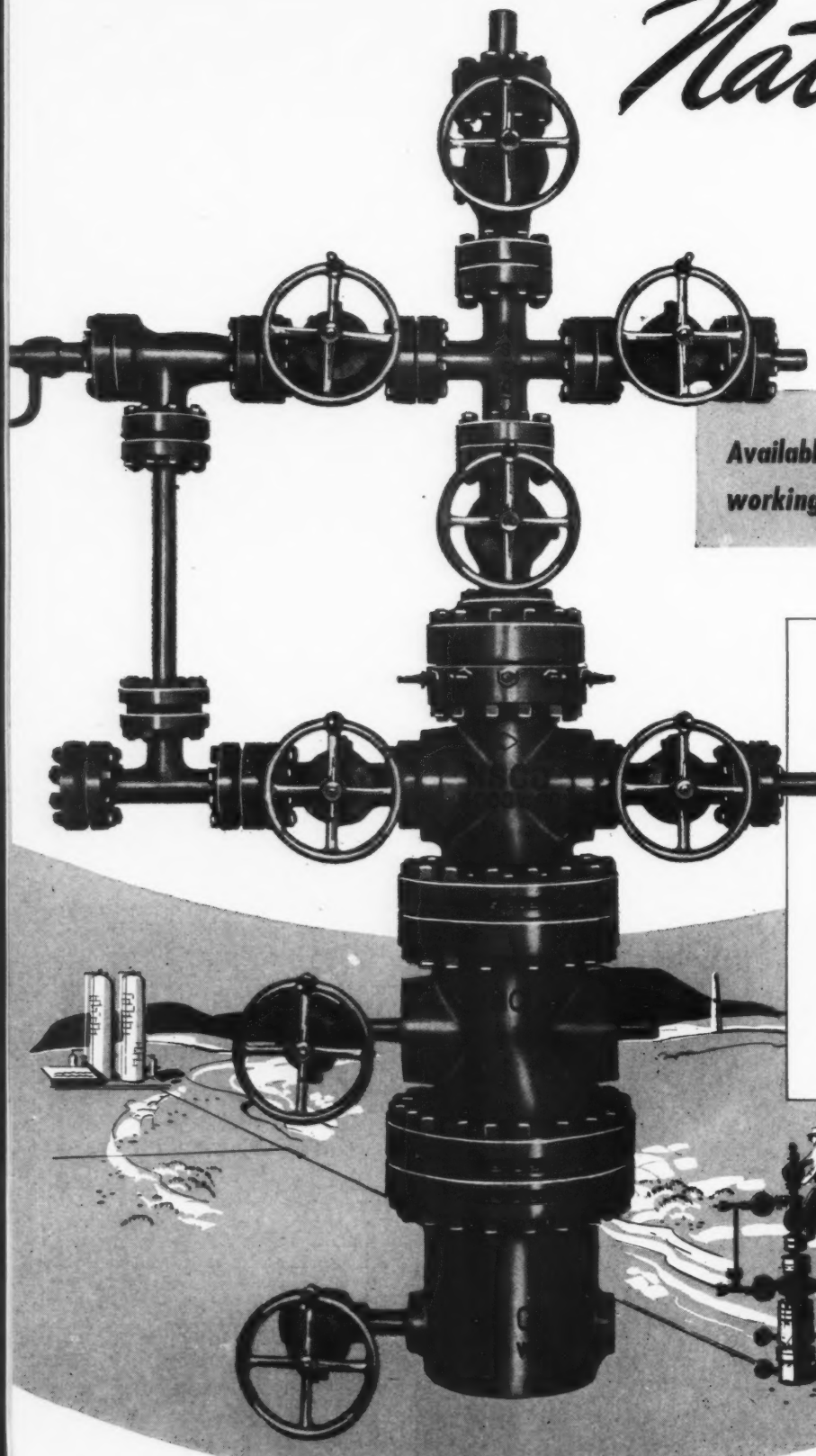
Left: Ramps of sand were thrown up along the line for convenience of Bedouins and their camels, but before the Abqaiq-Qatif 30-in. line was fully welded, camel caravans threaded through the remaining gaps

RECENT news items present significant facts of the current physical status of a construction project involving some of the greatest problems in logistics ever tackled by private industry. Other facts previously well known are that a pipe line across Arabia to the Mediterranean has been envisaged since before World War II as a logical, efficient means of bringing Arabia's abundant oil to vital markets; and that a line running from the rich oil center of Abqaiq on the Persian Gulf to a suitable port on the Mediterranean would be little more than a thousand miles in length —as against the 3,600-mile tanker haul via the Arabian Peninsula, Red Sea, and Suez Canal—saving the high tolls of the canal as well as obviating expensive tanker service.

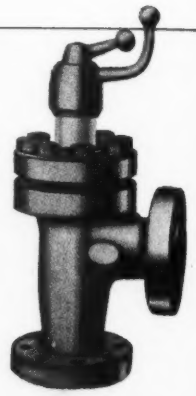
Right-of-way conventions were signed—some in 1946, others the following year—by officials of Trans-Arabian Pipe Line Co. (Tapline) and the governments of the countries concerned; and early in 1947 a route was selected. Construction was to be pushed from both ends with pipe 30

*Bechtel Corp.

National



Available in a complete range of test, working pressures, and test ratings.



NATIONAL (Adjustable) MICRO CHOKES

The National Type "D" Micro-Choke, which has its principal field of application on high pressure wells is a thoroughly modern design embodying many new features which obviate the undesirable characteristics commonly associated with chokes of the adjustable type.

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WELL HEAD EQUIPMENT

...meets all your individual requirements with MAXIMUM SAFETY and DEPENDABILITY

In National Type "B" Pressure Pack Well Head Equipment you have a modern, safe, full-opening line with every component part generously proportioned to sustain loads at reasonable stresses. Flexibility of design provides many different combinations of size, capacity and type to serve individual well requirements.

Assembly of National Type "B" Pressure Pack Well Head Equipment is extremely simple. Parts are self-locating and self-activating. No special tools or adjustments are required. Type "B" Packing is of double-lip construction. Positive sealing is thus assured, regardless of whether a higher pressure exists in the lower or upper annular space due to ineffective cementing and high pressure sands.

You can be assured of safe, economical and accurate well control when you rely on National Well Head Equipment. Write for a copy of Bulletin No. 113A or consult your nearby National Supply Store for complete details.

NATIONAL CASING HEAD TYPE KHL-1

The National KHL-1 Casing Head is a simple unit designed to seal off a single string of casing in wells of medium depths and pressures where an independent tubing head is used to support the tubing.

Slip construction permits setting casing with proper tension without using a spacer nipple. The independent packing assembly can be changed or compressed without disturbing the casing setting.

TYPE "A" CASING SUPPORT

The National Type "A" Casing Support provides economical means for supporting medium length casing strings where no pressures are to be packed off outside the casing suspended. A spider, supported on the coupling of the outer casing, holds the slips supporting the inner casing. Three-piece slips are assembled with a snap spring around the casing and lowered into the spider by means of wire rope handles. Hard slip wickers grip hardest grades of alloy pipe.

NATIONAL TYPE "W" TUBING HEAD

The National Type "W" Tubing head is an extremely flexible unit designed to support a string of tubing and to seal that string from the casing.

This equipment is for applications where an independent tubing head is desired for working pressures from 1,000 through 3,000 pounds per square inch.

THE NATIONAL SUPPLY COMPANY

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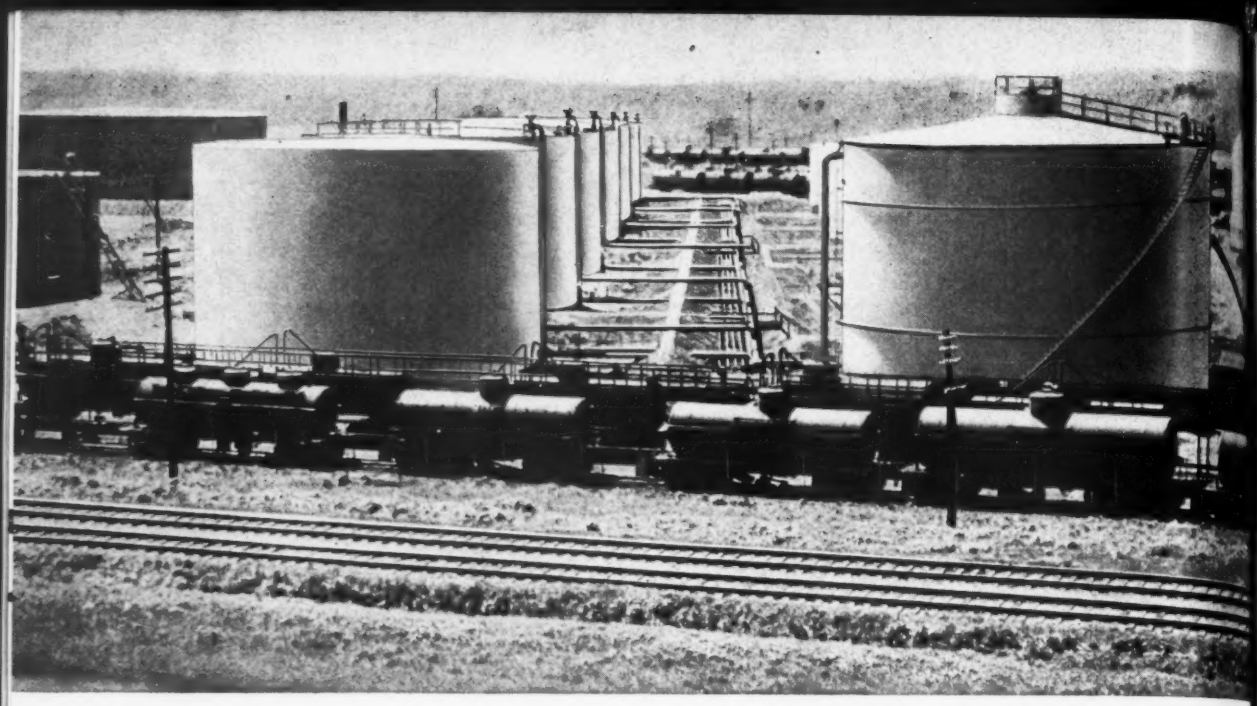
NATIONAL BLUE PRODUCTS



EVAPORATION THE ENEMY OF CONSERVATION

The Wiggins Dry Seal Gasholder shown above at the right, interconnected to six storage tanks is enabling a prominent oil company to turn vapor losses into profits. Today — more than ever before — this is both a patriotic and economic necessity.

A new booklet "Wiggins Vapor Balancing Systems" is now available. It describes and illustrates many exclusive Wiggins design and construction features of both the Wiggins Lifter Roof and the Wiggins Dry Seal Gasholder.

WIGGINS CONSERVATION STRUCTURES

- Hidek Floating Roofs
- Lodek Floating Roofs
- Balloon Roofs
- Breather Roofs
- Dry Seal Lifter Roofs
- Dry Seal Gasholders

Charts of various types of evaporation losses, a graph and "Pay-Out Analysis" table should prove valuable to every executive and engineer responsible for the efficient storage of products subject to evaporation losses. Write for a personal copy today.

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FRANCE Etablissements Driattre & Frouard reunis, Paris

An aboveground section of the trans-Arabian pipeline is about to be tied in. The final tying together of various-length sections between anchors and deflection points is rigidly controlled to assure a uniform temperature of 90° F. at the time of each union. This temperature is the mean between the minimum and maximum expected to occur in operation

and 31 in. in diameter having a capacity in excess of 300,000 bbl. per day. International Bechtel, Inc., a company already doing work in Arabia for the Saudi Arab Government and Arabian American Oil Co. (Aramco), was to build from Abqaiq northwesterly about 650 miles. The story of Tapline's first year in Arabia is one of pioneering and achievement in the face of many difficulties.

The Arabian section of the line was to pass through a wilderness with few roads, its only inhabitants the wandering Bedouins in constant quest for pasturage for their goats, sheep, and camels; a wilderness lacking in fresh surface water or food resources for construction forces; a wilderness of sand dunes, eroded valleys, briny sinkholes, and vast gravel plains, in the higher parts of which the temperature sometimes drops to freezing in winter and rises to 130° F. in the shade in summer; a parched wilderness whose dusty trails are sometimes turned into rivers of mud by heavy rains.

The main camp and unloading point was to be at Ras el Misha'ab, an uninhabited stretch of sand bordering the Persian Gulf just south of the neutral zone between Saudi Arabia and Kuwait. The reason for the selection was that here was the nearest practicable approach from the sea to the Bechtel portion of the pipe-line route as a whole. Access roads could stretch across the desert to Abqaiq, the starting point of the line 170 miles to the southeast; to Hafar al Batin, an Arabian fort 150 miles westward along the route from Abqaiq; or to any pumping-station site or construction center in between. These facts were ascertained in the spring of 1947, when Tapline and Bechtel officials and engineers made reconnaissance flights up the coast, then explored the ground with motor cars and trucks.

Travel Hardships

On July 12 a small party of engineers, construction men, and a few Arab helpers set out with a truck convoy, including a tractor and crane on trailers, from Ras Tanura, Aramco's refinery center on the Persian Gulf, and drove to Ras el Misha'ab. Though there was a road of sorts, the going was tough with the heavy equipment, and the 140-mile journey took 3 days. The sight which met eyes of the newcomers was uninspiring. It was nothing but an expanse of sand at the edge of the turquoise sea. The temperature was at least 120° in the shade, but there was no shade. The men attempted to erect three tents in a freshening breeze; they succeeded in getting only one up, for the breeze quickly turned into a dreaded shemal, a blinding sandstorm, that lasted for 3 days. Meanwhile a truck had been sent to fetch drinking water from El Jauf, an Aramco well 40 miles inland, but before it got back the last bottle of precious water in the party was accidentally dropped and broken.

From this unceremonious beginning Ras el Misha'ab grew in 9 months into an imposing modern town with a population of 500 Americans and 1,500 Arabs. It was complete in all respects, with power plant, sewage-disposal and water system, a score of 24-man barracks, a 500-man mess hall, a 40-bed hospital, a recreation hall, a laundry, machine shop and garage, warehouses and office buildings, nurses' residence, and family dwellings. There were also Saudi Arab customs and immigration buildings, and a residence for the local emir. Some of these structures were locally made marl bricks. There were areas for the storage of incoming miscellaneous equipment and pipe. There were two causeways for berthing barges, and a 3-mile-ship-to-shore "skyhook" cableway—the only one of its kind in the world.

All main camp and harbor construction has since been finished, and the Skyhook—whose superstructure was erected by Pointer-Willamette Co. of Portland, Ore.—has been in operation since early May. During the past 12 months 65 ships from America have been unloaded at Ras el Misha'ab, in whole or in part, and the 200,000 measurement tons they carried for Tapline have been assimilated. All the surveying, from the Persian Gulf to the Mediterranean, has been done, and a substantial amount of pipe has not only been laid but actually placed in service.

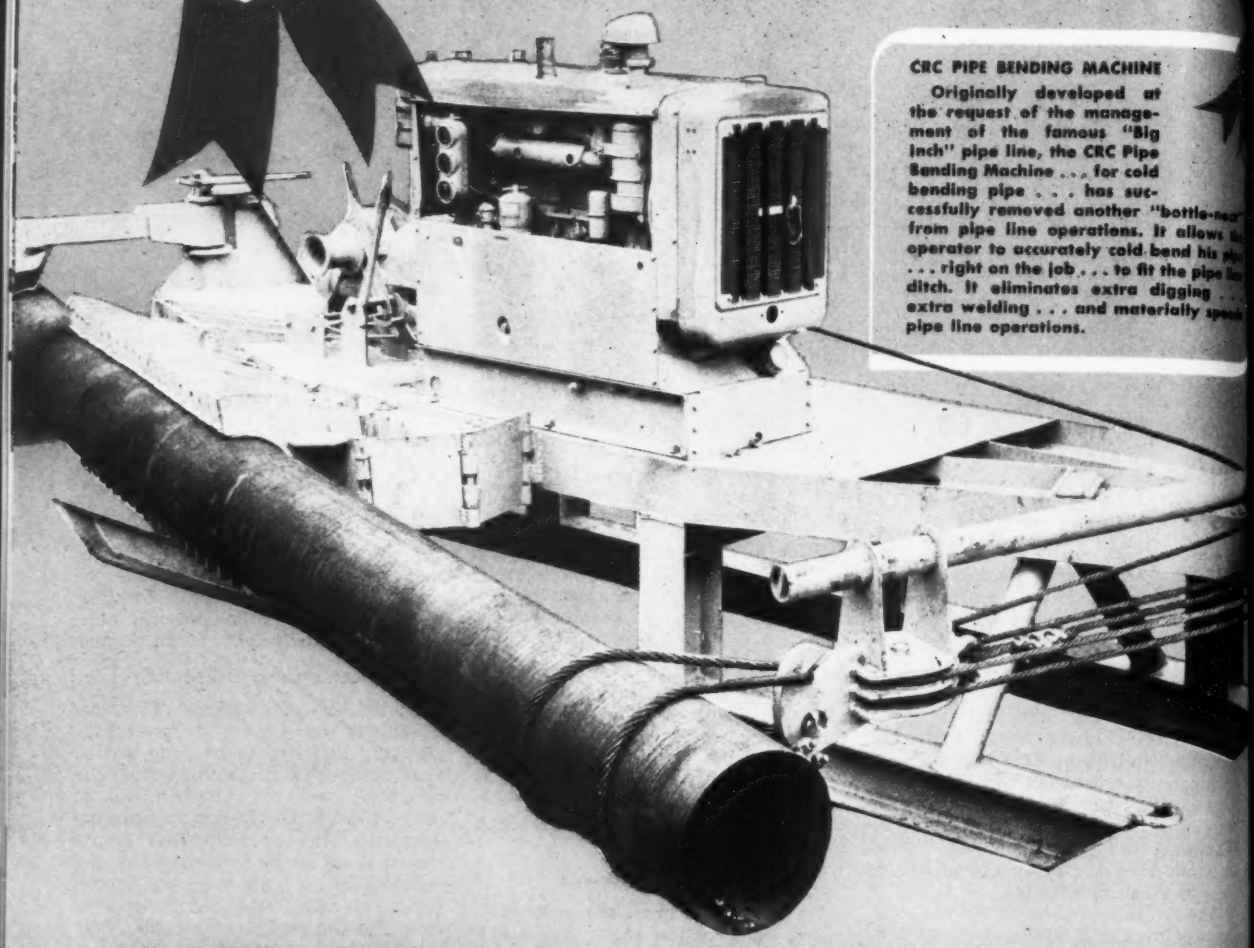
Planning and Scheduling

Behind this year's record of accomplishment lies a story of prodigious planning that had to be done in San Francisco, 10,000 miles away from the job site; and so complete did it have to be to insure continuing operations in the field that it assumed some of the proportions of the logistics for an army invasion. Everything, literally, had to be shipped from the United States because of an almost total absence of local markets. To be procured and shipped were not only the materials for the permanent installations—the pipe line and pump stations—but construction and transportation equipment, repair facilities and spare parts, housing, and all foodstuffs and supplies essential for the livelihood and well-being of the hundreds of American workers who had to be recruited and transported.

Active planning started in March 1947, purchasing started early the following month, and on June 19 the first contingent of men left for Arabia to meet the first shipment of supplies for the project. By December 1947 the planning had been finished and 90 per cent of the requirements for the job had been shipped or were at dockside awaiting shipment. There were more than 5,000 separate purchase items, not including spare parts, which numbered over 30,000.

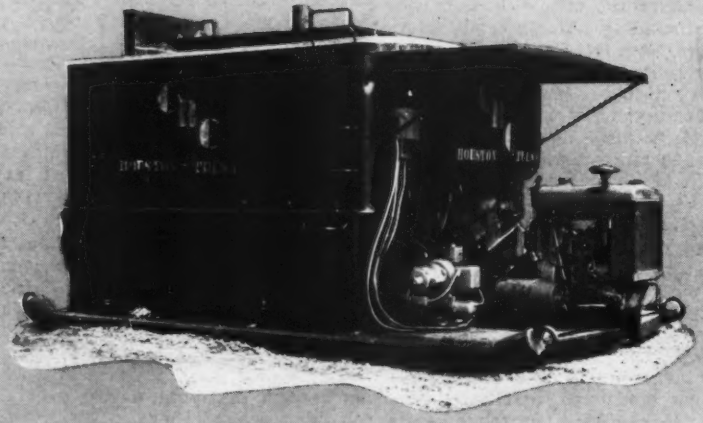
The client and constructor worked closely together in the scheduling of equipment and materials so that the arrival in Arabia of the two would coincide with the agreed progress

C·R·C



CRC PIPE BENDING MACHINE

Originally developed at the request of the management of the famous "Big Inch" pipe line, the CRC Pipe Bending Machine . . . for cold bending pipe . . . has successfully removed another "bottle-neck" from pipe line operations. It allows the operator to accurately cold bend his pipe . . . right on the job . . . to fit the pipe line ditch. It eliminates extra digging . . . extra welding . . . and materially speeds pipe line operations.



CRC *Coating* and *Wrapping* Machines

The flexibility, precision, speed and economy of CRC Coating and Wrapping Machines is reflected in the satisfaction expressed by pipe line operators everywhere. With this self-propelled, advanced-design machine, pipe is coated and wrapped just before the pipe goes into the ditch. In one operation, it applies a uniform coating of one coat and one wrap, or two coats and one wrap or two coats and two wraps. Can be adapted to meet individual needs for multiple coats. Big Inch Machines (20"-26") now equipped with Williams Oil-O-Matic Burner which assures uniform temperature of paint from asphalt kettle to pipe.

CRC TAR KETTLE

Brings new advantages to the field for both contractor and company, and the result is a better pipe line job at lower costs. Here are the general features: Agitated mechanically—thermostatically controlled burners—completely insulated throughout, including fire-box and door—available in 15 and 30 barrel capacities—greater speed—choice of butane or fuel oil burners.

A WINNING TEAM FOR FAST, ECONOMICAL PIPELINE OPERATIONS

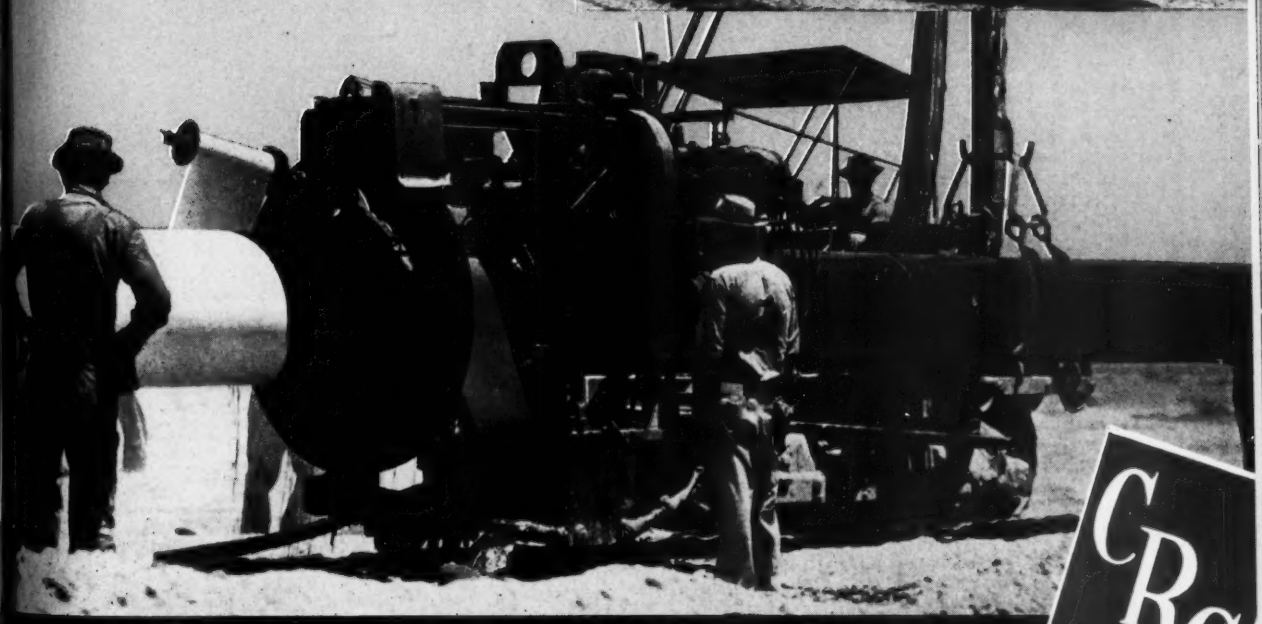
The Crutcher-Rolfs-Cummings organization has specialized *exclusively* in pipe line equipment for more than 15 years. And because we have specialized *exclusively* in pipe line equipment and materials, we have been able . . . through active field service by qualified personnel . . . to continually build better pipe line equipment year after year.

Right now, there are more than 100 CRC employees devoting their time exclusively to working for the pipe line industry . . . to building, re-designing and developing exclusive design equipment. We are better tooled and better equipped with greatly expanded shop facilities (other new plant facilities now under construction) to help you build even better pipe lines at lower and lower costs.

Your CRC Representative will be glad to take you to the field or our Houston or Tulsa plant to demonstrate the typical CRC equipment shown here.

CRC PIPE CLEANING AND PRIMING MACHINES

Basic advantages of this standard Model "C" CRC Pipe Cleaning and Priming Machine are that it is stronger, more durable and provides maximum simplicity in changing from one pipe size to the other in the field. The Model "C" CRC Pipe Cleaning and Priming Machine is perfectly balanced on an "H" box frame construction. It is built in three sizes, 3" to 14" 14" to 20" and 20" to 26".



CRC

CRUTCHER-ROLFS-CUMMINGS INC.

PIPE LINE EQUIPMENT AND MATERIALS

HOUSTON-TULSA

Pumping easily from almost 9,000 feet

An Allis-Chalmers L844, High Torque power engine unit as prime mover on a well that is producing from below 8,700′.

This positive governor controlled engine develops 590 ft. lbs. torque at 700 r.p.m. and 108 h.p. at 1,000 r.p.m. fully equipped. Its continuous governed operating range is 600-1,200 r.p.m.

This unit has: Removable wet cylinder liners; Three interchangeable cylinder heads; Inserted valve seats; Valves in head and Dual carburation. Low cost Replacement Motor Kits, fitted and ready for installation are available for all FIVE sizes of Allis-Chalmers power engine units.

FRED E. Cooper, Inc. TULSA, OKLA

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HOUSTON [illegible] HOLLYWOOD [illegible]

schedule. (Tapline procured all the pipe, pump-station, and other permanent facilities, while Bechtel procured practically everything else.) To assure delivery at the job site in orderly sequence, all purchases were scheduled on the basis of an anticipated delivery time from dockside in the United States to the unloading point on the Persian Gulf.

The scheduling of manpower by crafts was faithfully carried out in the early days of the project so that men of proper skills and classification would arrive at the job site coincident with the materials they were to use and at an appropriate stage of the project.

It was necessary for the owner to make representations to the Office of International Trade, estimating by quarters the requirements of all items calling for export license approval before they could be shipped from the United States; and this in itself was a sizable task.

Another example of scheduling had to do with the forecasting of tonnage shipments from both East and West Coast ports. Most of the equipment and general supplies for camp construction and personnel maintenance were sent to Arabia on ships which also carried Aramco materials. Close liaison was therefore necessary to insure shipment on schedule to meet the needs of both companies.

If any one item were forgotten, 6 months might elapse before it could be delivered; for the routine had to be followed of obtaining approval for it from Tapline, requisitioning and purchasing it, receiving it, and finally shipping it. Thus the project had to be fully equipped for a minimum period of from 9 to 12 months of initial operation.

Consideration always had to be given, of course, to the pecularities of the climate and terrain of the country wherein the pipe line was to be built; and special equipment ranging from DDT sprayers to low-pressure sand tires had to be furnished.

The first supply ship reached Ras el Misha'ab in August 1947. She dropped anchor about 2½ miles off shore, as close as the shallow water would permit, and discharged her cargo onto barges. These were berthed at a high-tide dock prepared in advance by trucks, bulldozers, and a crane brought overland from Ras Tanura. Limestone quarries were opened up a mile or two from the landing beach, and two causeways were soon far enough advanced to make possible the unloading by barge of 1,000 tons a day from the Liberty and Victory ships that were coming several times a month.

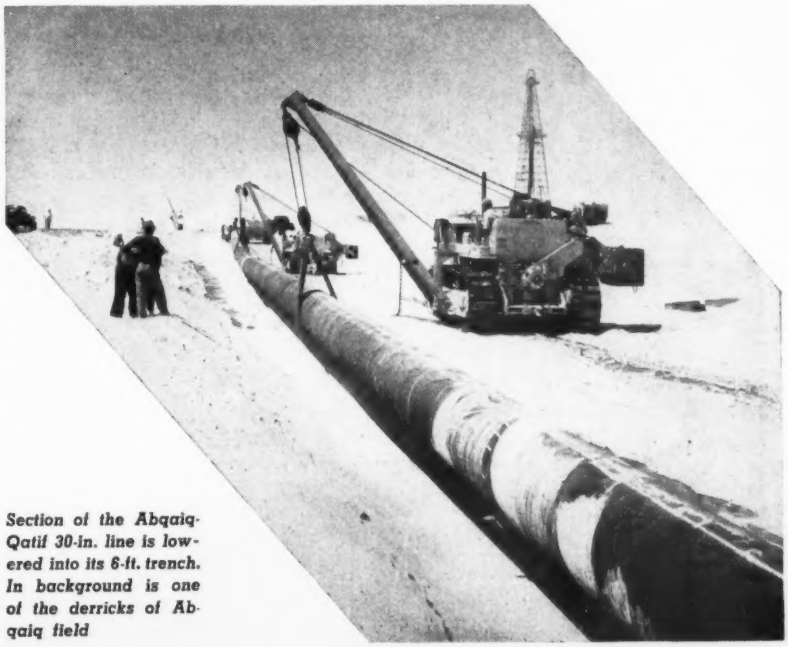
Skyhook Speeds Unloading

Meanwhile work was being done on the Skyhook installation. Originally devised to haul heavy timber out of otherwise inaccessible locations in swampy or mountainous country, the Skyhook was being adapted at Ras el Misha'ab especially for the bringing ashore of pipe. Pilings were to be driven to support the 75-ft., 7-ton timber towers, of which there were to be 24. Five of these were to extend a half mile over the desert, the remainder being over water. A 2½-yd. crane raised the on-land towers, while the others were assembled on shore, floated to their places, and lifted by a converted pile driver. Guyline, jack-hanger straps, and traction-line supports were attached to the towers before they were raised. Skyroad cables were secured at the landward end by a heavy anchor frame buried in subkha mud which hardened like concrete when dry, and at the seaward end H-beam pilings were driven in 35 ft. of water. The sea island, to which vessels are moored to discharge their pipe, is a decked-over structure 400 by 80 ft. supported by steel pilings.

By early April all the towers were

(Continued on page 288)

Finishing touches are put on a 13°-anchor bend in the Abqaiq-Qatif portion of the Trans-Arabian pipe line



Section of the Abqaiq-Qatif 30-in. line is lowered into its 6-ft. trench. In background is one of the derricks of Abqaiq field

Semiautomatic Pump-Station Controls

On Borger, Tex. — Denver Products Line Operated Jointly by Phillips and Shamrock

by G. P. Jennings* and David A. Roach*

THE Borger-Denver products line, a joint venture by Phillips Petroleum Co. and Shamrock Oil & Gas Corp., has been in operation since December 1947 as far as La Junta, Colo. After an extensive study of the economics involved, it was concluded that for this particular line electric power and triplex plunger pumps were justified, provided they could be at least semiautomatic to hold labor operating costs to a minimum.

The McKee station receives Shamrock products from the refinery close by and Phillips products from Rocky station near Borger, Tex., and 37 miles south of McKee. Two variable-stroke and one constant-stroke pumps are installed at McKee, each capable of developing 1,500 lb. differential at a delivery rate of 3,100 bbl. per day. At Rocky station only one variable-stroke pump is installed; however, it is fitted with much larger plungers and is capable of loading the three pumps at McKee. All pumps are driven by 100-hp. explosionproof motors.

McKee station controls will be described since they govern three units. Controls at Rocky station are similar but not as extensive since they govern only one unit.

The air-actuated instruments consist of the following:

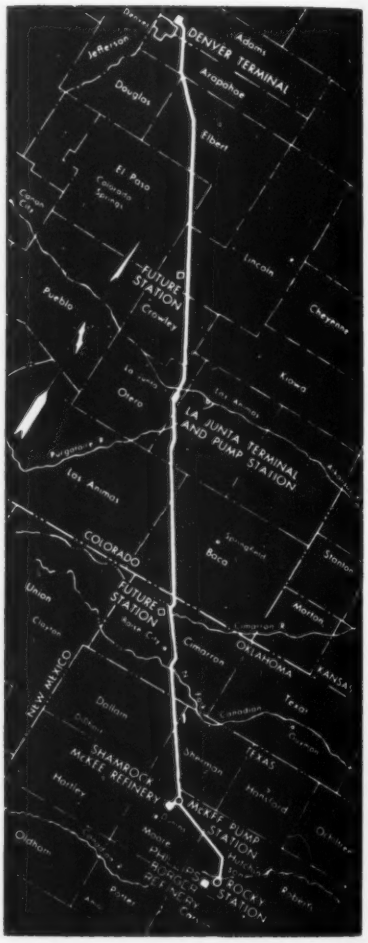
1. Dual air system suction pressure controller, direct acting.
2. Dual air system discharge pressure controller, reverse acting.
3. Dual air system rate-of-flow controller receiving its indication from an indicating flow transmitter.
4. Single air system underpressure alarm.
5. Single air system overpressure shutdown.
6. Two three-way air pilot valves.

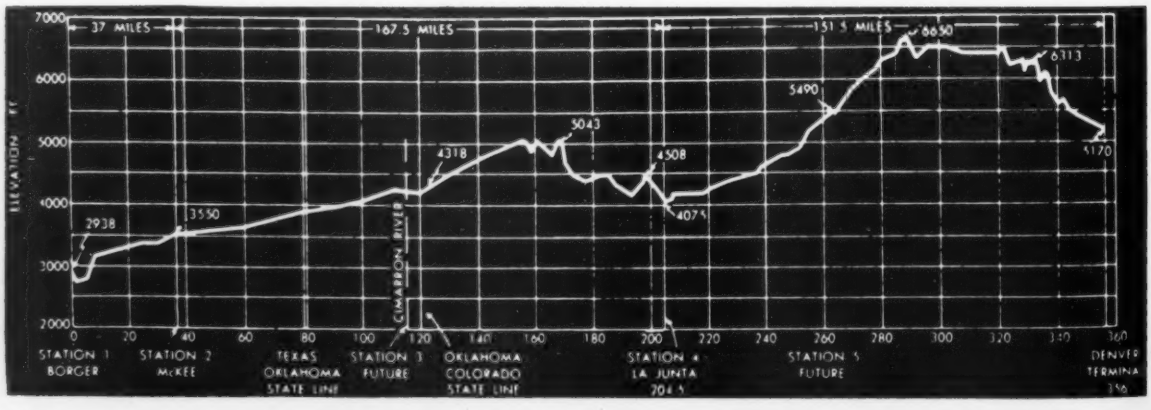
*Phillips Petroleum Co.

Two Air Systems

There are two air systems. The No. 1 air system does all of the controlling of variations in pressure or flow by changing the stroke on the variable-stroke pumps, while the No. 2 air system simply starts and stops the constant-stroke pump. The suction-pressure controller and the rate-of-flow controller all operate on both air systems and are equipped with adjustable sensitivity, automatic reset, and preact on the No. 1 air system, but only with adjustable sensitivity on the No. 2 air system. An air dryer is used on instrument air.

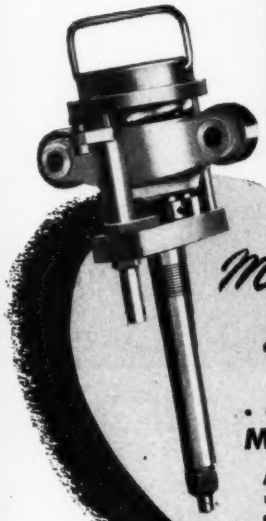
We will assume that McKee station is receiving from Rocky station at about 5,000-bbl.-per-day rate and we wish to hold 30 lb. intake pressure at McKee operating one variable and one constant-stroke unit. Twenty-pound air is admitted to the suction-pressure controller through No. 1 air system. This air is connected to the stroke regulator on one of the variable-stroke pumps by way of the discharge controller and rate-of-flow controller. Air is bled off of the suction controller to maintain the proper





Right: Route of Borger-McKee-La Junta-Denver products pipe line of Phillips Petroleum Co. Below: Profile of pipe-line route

Here's why a MURPHY DIESEL delivers more usable power per dollar



the Murphy Unit Injector

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A simple dependable unit injector for each cylinder serves as both pump and nozzle and eliminates *all* high pressure fuel lines.

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2. IT IS A "TRUE" DIESEL!

Built for heavy-duty sustained loads, Murphy Diesels will give you more uninterrupted power, day in and day out, for every dollar you invest. Both from the standpoint of first cost and operating expense *Murphy Power is economical power.* "True" diesel operation—solid fuel injected directly into a plain, open combustion chamber—plus Murphy Unit Fuel Injection means you get the most out of every gallon of fuel. In addition, these features are your best assurance of dependable service and long, trouble-free operation.

Get complete information from your Murphy Diesel Dealer or write direct. Ask for a copy of the booklet *"7 Questions to Ask a Diesel Engine Salesman."*

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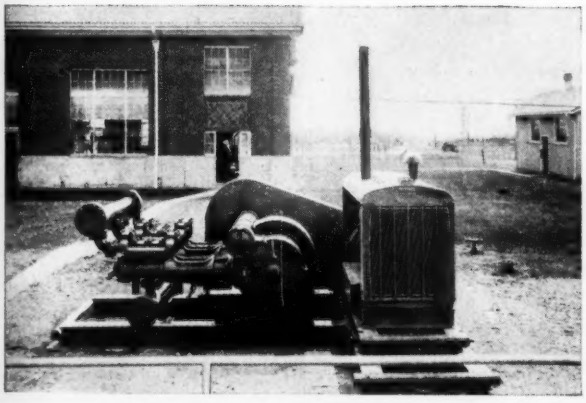
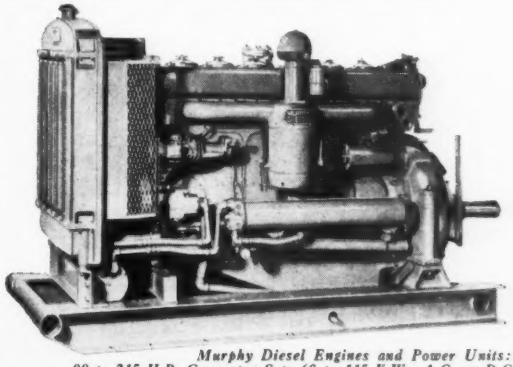


This 150 H.P. Continuous, 180 H.P. intermittent Murphy Diesel powers a pump owned by the Texas-Empire Pipe Line Co.



Murphy Diesel Engines and Power Units: 90 to 215 H.P. Generator Sets 60 to 115 K.W., A.C. or D.C.

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LOWEST ULTIMATE POWER COST

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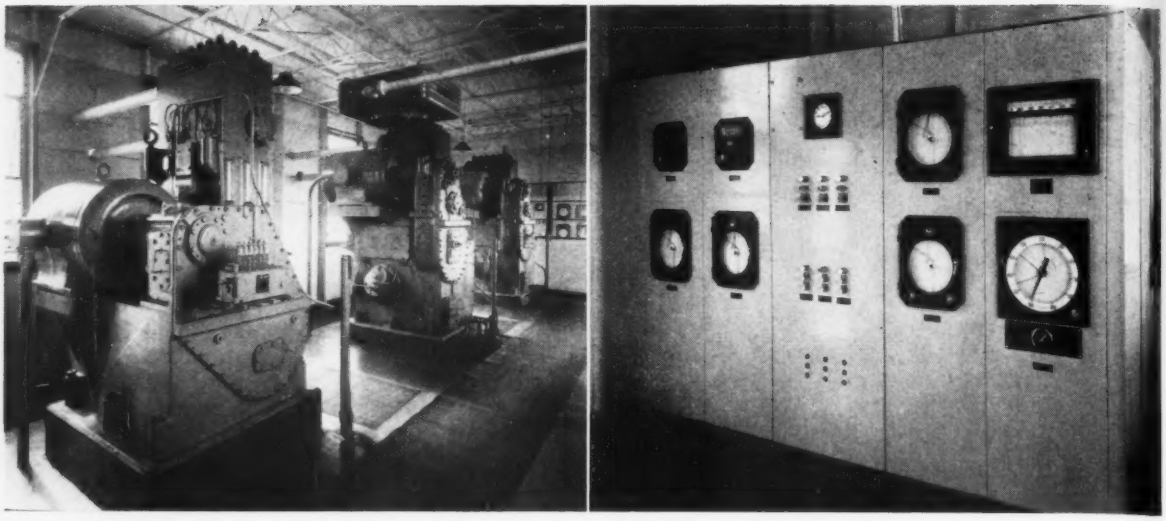


Left: Pumping equipment at McKee station with instrument board in the rear. Right: Instrument board located in control room at McKee pump station. Start and stop switches with indicating lights on center panel: potentiometer and potentiometer controller on right-hand panel; and other instruments described in article

air pressure on the stroke regulator, thus regulating the volume pumped which in turn controls the desired 30 lb. station-intake pressure. Assuming the maximum set discharge pressure is above the operating discharge and the rate of flow is set above the actual rate of flow, then the discharge controller and the rate-of-flow controller are inoperative and simply act as passageways for the air.

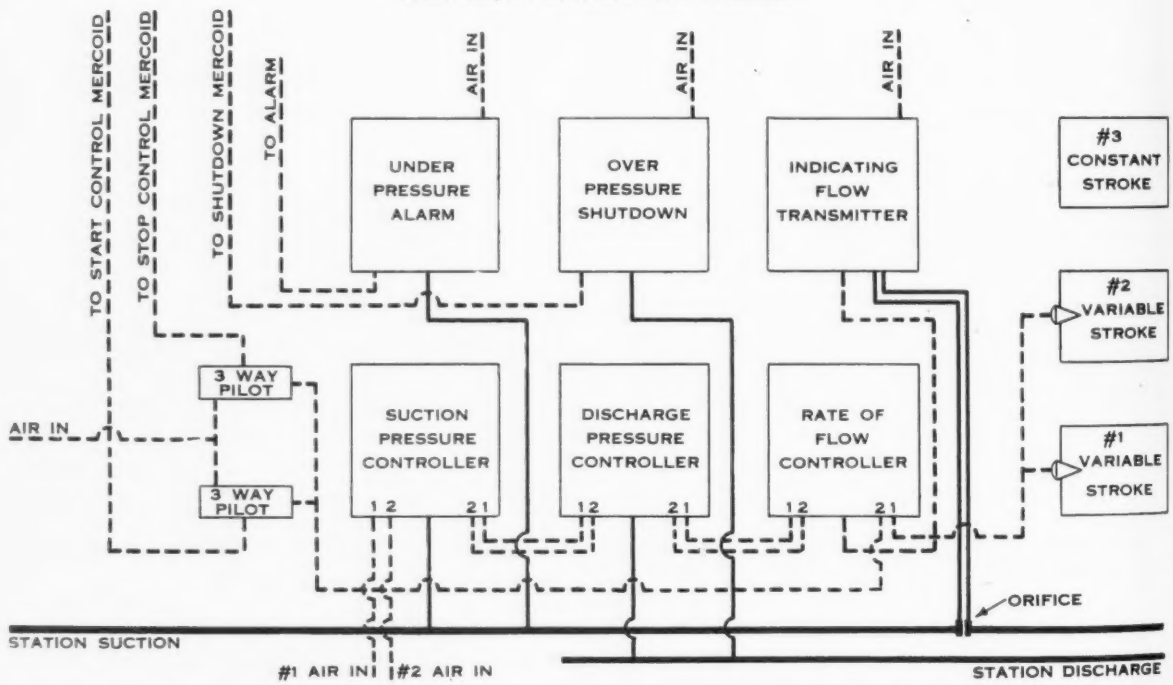
We will now assume that the flow rate coming into McKee station starts falling below 5,000 bbl. per day and as this happens the stroke on the variable-speed pump decreases until it reaches zero stroke, at a rate of about 3,100 bbl. per day or the capacity of the constant-speed pump. As the rate falls still lower the suction pressure will drop below the desired 30 lb., at which time the suction controller bleeds off air from the No. 2 air system and lowers the pressure on one of the three-way air pilot valves which admits air to a mercoid switch and stops the constant-stroke unit. The station-intake pressure then immediately builds up and increases the stroke on the variable-stroke pump through the No. 1 air system.

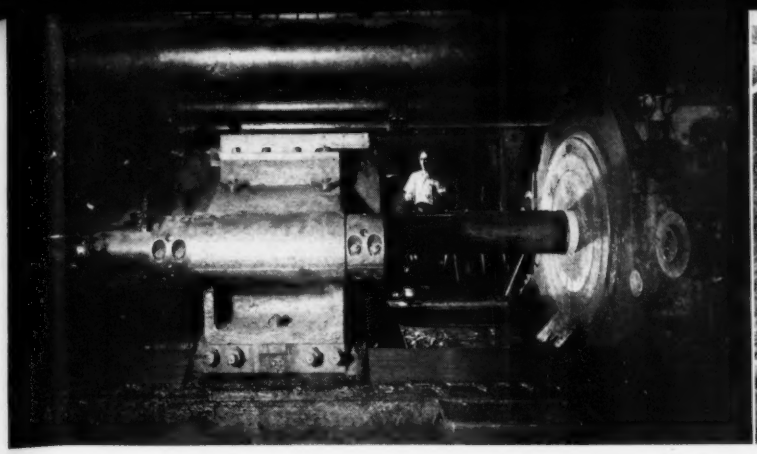
If the intake rate then comes up above the 3,100-bbl.-per-day capacity of the variable-stroke pump, the intake pressure will rise and the suction-pressure controller will close the bleed on the No. 2 air system, admitting a high air pressure to the other three-way air pilot valve which also operates a mercoid switch which starts the constant-stroke unit.

The discharge-pressure controller operates in the same general way as the suction-pressure controller described above whenever the set discharge pressure is reached. The same

(Continued on page 238)

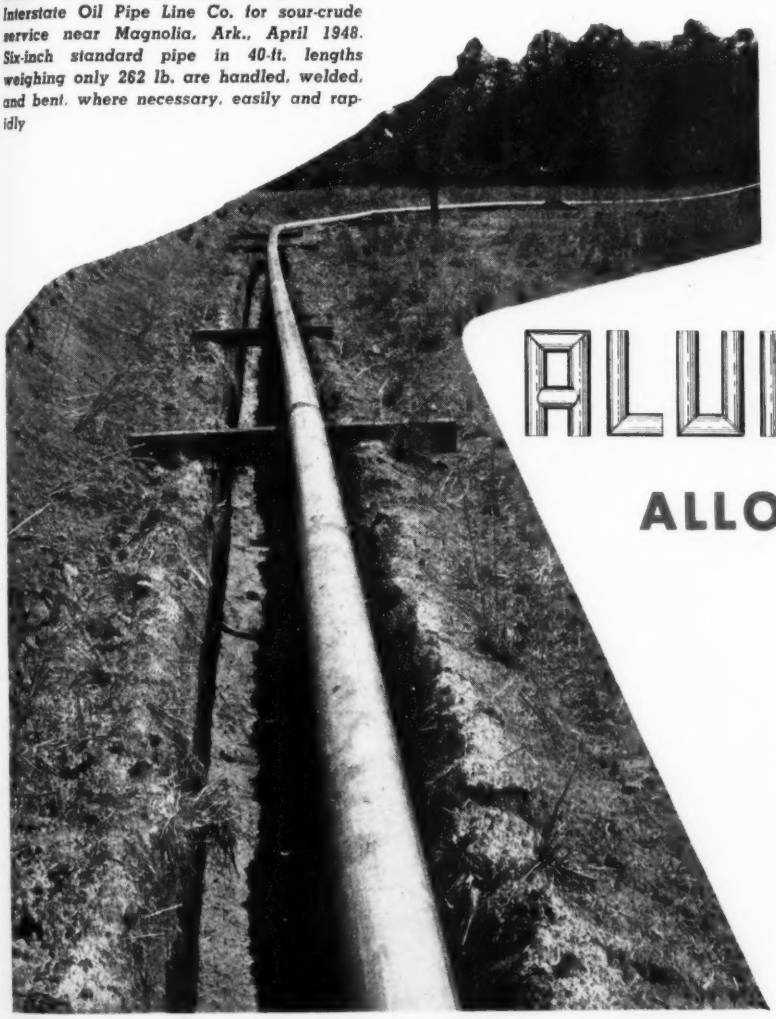
Control diagram for McKee station installation





Left: Extrusion press used to produce aluminum pipe. Preheated billet being pushed into chamber at right by hydraulic ram. Plastic metal is forced to flow through circular die and around central mandrel forming finished pipe in a single operation. Right: Welding 4-in. aluminum pipe. Welder holds torch with white-hot tungsten electrode in right hand and coil of filler wire in left hand. Half-mile of pipe was welded at this one location with string of pipe pulled ahead by cat as joints were completed

Welded aluminum pipe line being laid by Interstate Oil Pipe Line Co. for sour-crude service near Magnolia, Ark., April 1948. Six-inch standard pipe in 40-ft. lengths weighing only 262 lb. are handled, welded, and bent, where necessary, easily and rapidly



by B. J. Fletcher

Welded ALUMINUM ALLOY PIPE LINES

THE urgent need of the petroleum industry for tubular goods has focused attention on aluminum alloy pipe. During the summer of 1947 the mills had considerable capacity in excess of current requirements. Since then the general demand for aluminum has risen more rapidly than production of the metal, so today aluminum pipe is on the list of materials which are in short supply. In spite of this, studies and experimental work on aluminum alloys for pipe lines indicate that aluminum will have a permanent place in the pipe-line field because of its resistance to corrosion and the ease with which it can be handled.

History of Aluminum Pipe Lines

Prior to the war, aluminum was not used in pipe-line work. There were three principal reasons for this: (1) the cost was high as compared with steel; (2) the general level of resistance to corrosion of aluminum alloys strong enough to withstand pipe-line pressures, was questionable; (3) welding methods then available were not suitable for pipe-line construction.

During the last 10 years this picture has changed. The price of aluminum pipe has fallen while that of steel has risen, thus reducing the cost differential; magnesium-silicide-type alloys, with greatly improved resistance to corrosion, have come into common use and are available in the form of pipe; third, a new method of welding, eliminating previous disadvantages, has been developed.

When aluminum was first proposed for pipe lines there were two major problems. No one had the knowledge

or the equipment required for field welding aluminum pipe, and no one knew how long aluminum pipe would last under the corrosive influence of sour crude, or of various types of soil. This spring the successful completion of experimental field-welded lines for Interstate Oil Pipe Line Co.* demonstrated that aluminum lines can be laid rapidly and efficiently. The length of life of aluminum pipe remains to be proved, but extensive test work, together with limited experience, indicates that it will be satisfactory.

It is interesting to note that the original use of aluminum for pipe lines was based on the desire for light weight rather than resistance to corrosion. During the latter part of the war, Army engineers tried out aluminum tubing for invasion pipe. Portability by manpower and by airplane was tremendously increased, because aluminum pipe weighs only one-third as much as steel in equal sizes. Experiments made with thin-wall aluminum tubing carrying thick stub ends grooved for Victaulic-type couplings have demonstrated that the production of such tubing presents no unusual problems, and that the aluminum alloys have sufficient strength for this purpose. Similar tubing is being tried out for civilian use on construction and drilling projects to handle water and fuel.

Removable flanged sections of 6-in. aluminum pipe line. At this wet location, Interstate Oil Pipe Line Co. inserted bolted sections which can be readily removed for future inspection

While the current supply of aluminum pipe is limited, it is believed that adequate supplies will be available in the future. In the meantime, limited amounts are available for test installations, and every effort is being made to utilize this pipe in a means which will give a complete story on corrosion resistance.

*See article in The Oil and Gas Journal, April 22 and April 29, 1948.

Welded 4-in. aluminum pipe line being laid by Interstate Oil Pipe Line Co. in marshy ground near Delta Farms, La., May 1948. Small cat carries eleven 40-ft. lengths of pipe while welder completes a joint. Hobart field welder with argon gas bottle at left

Alloys and Sizes Used for Aluminum Pipe Lines

A brief discussion of alloys and sizes of aluminum pipe may be helpful to those contemplating its use. Commercial and technical data given in this article refer to the product and investigations made by Aluminum Co. of America, but it should be noted that aluminum tubing is manufactured by several other concerns.

The most satisfactory aluminum pipe alloys available commercially today are of the heat-treated magnesium-silicide type designated as 63S-T6 and 61S-T6. Both of these alloys have excellent resistance to corrosion in many environments; both have sufficient strength to withstand pressures normally used in the smaller sizes of pipe; both have good welding characteristics. The chemical composition of these alloys is shown in Table 1. It is interesting to note that aluminum forms over 97 per cent of both alloys and that strength characteristics are improved by small, closely controlled amounts of other elements together with heat-treatment of the resulting alloy.

TABLE 1—NOMINAL COMPOSITION OF ALUMINUM ALLOYS 61S AND 63S

	Per cent of alloying elements—Aluminum and normal impurities constitute remainder			
Alloy—	Copper	Silicon	Magnesium	Chromium
61S	0.25	0.6	1.0	0.25
63S	....	0.4	0.7	...

The typical physical and mechanical properties of these alloys are given in Table 2.

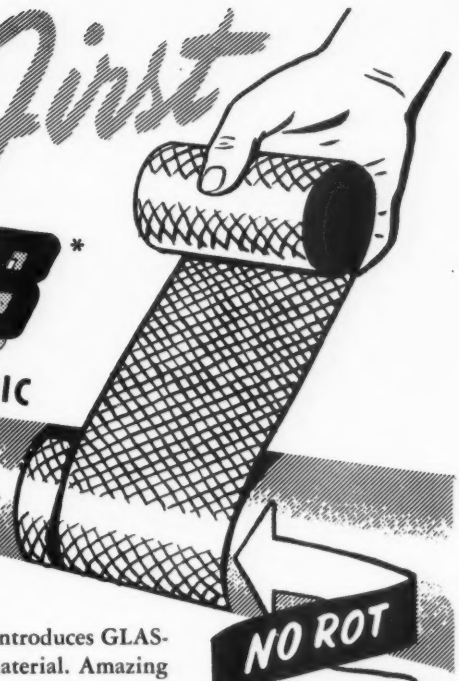
It is evident that the two alloys are very similar except the tensile strength of 61S-T6 is about 30 per cent higher than 63S-T6 in the unwelded condition. The difference in price favors 63S-T6 by about 12 per

Assembly of welding neck flanges on 6-in. aluminum pipe. Aluminum alloy flanges made by Tube Turns, Inc., are used to join aluminum to steel pipe and for removable sections in aluminum line. Bolts and nuts are aluminum alloy and insulating gaskets and bushings are used at aluminum-steel joints

Another MIDWESTERN First

GLASFAB*

REINFORCING MEMBRANE FABRIC



NO ROT
NO CHAR
NO WEAR
NO TEAR

* Made of
OWENS-CORNING
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B. J. Fletcher is chief engineer of the development division of Aluminum Co. of America, to which position he was appointed in 1944. He devotes his time to the structural, marine, building, and construction fields. A graduate of M.I.T., he joined Alcoa in 1930 and has held positions in several departments, and during the war he concentrated on numerous war projects, including the atomic bomb, for which work he received a meritorious government citation.

TABLE 2

Alloy—	61S-T6	63S-T6
Weight per cu. in., lb.	0.098	0.098
Tensile strength, psi.	45,000	35,000
Tensile yield strength, (0.2% set), psi.	40,000	30,000
Elongation in 2 in. (½-in. diam. specimen)	17	16
Modulus of elasticity, psi.	10,000,000	10,000,000
Coefficient of expansion per 1° F.	0.000013	0.000013

cent so, unless absolutely maximum strength is required, alloy 63S-T6 is the usual choice for pipe lines.

Aluminum pipe is manufactured by extrusion which produces seamless tubes by forcing cast billets, heated until they become plastic, through suitable dies under extremely heavy pressures. Such pipe is uniform, very smooth, and free from flaws. Standard pipe sizes through 12¾-in. outside diameted are produced by direct extrusion. Tubing having special diameters and wall thicknesses is made by extrusion or by a combination of extrusion and cold drawing.

At present, high-strength aluminum pipe is not being produced from formed and welded plate, and there is no prospect that such pipe will be available in the near future. For practical purposes, aluminum pipe is limited to standard sizes of 12 in. or less as shown in Table 3. Extra-heavy pipe sizes are also produced.

Maximum lengths of aluminum pipe vary with weight per foot, the principal limitation being the weight of the billet which the extrusion press can handle. Typical maximum commercial lengths for standard pipe sizes are as folows: up through 6 in. 50 ft. or more; 8 in. 40 ft.; 10 in. 30 ft.; 12 in. 25 ft.

Dimensional tolerances for aluminum pipe as produced by Alcoa are similar to those for steel. For sizes 2 in. and over the tolerance on outside diameter is plus or minus 1 per cent of nominal; length tolerance is minus 0 plus ¼ in.; wall tolerance is minus 12½ per cent. There is no plus tolerance specified but as aluminum pipe is priced on a per foot basis it is obvious that the mills will hold overruns in wall thickness to a minimum. Each length is marked to show alloy, grade, and temper and origin, thus assuring the selection of the correct material from stocks.

TABLE 3—ALUMINUM ALLOY PIPE SIZES, DIMENSIONS, WEIGHT, PRICE, BURSTING PRESSURE

Nominal size	Outside diam., in.	Wall thickness, in.	Weight lb. per ft.	Weight lb. per mile	Price* 61S-T6 $/ft.	Price* 61S-T6 $/mile	Price* 63S-T6 $/ft.	Price* 63S-T6 $/mile	Approx.† bursting strength, welded joints, psi. 61S-T6	Approx.† bursting strength, welded joints, psi. 63S-T6
2	2⅜	0.154	1.26	6,663	0.40	2,132	0.36	1,879	4,300	3,100
2½	2⅞	0.203	2.00	10,571	0.62	3,277	0.55	2,928	4,600	3,400
3	3½	0.216	2.62	13,818	0.81	4,284	0.72	3,827	4,100	2,950
3½	4	0.226	3.15	16,616	0.96	5,068	0.84	4,436	3,700	2,700
4	4½	0.237	3.73	19,689	1.14	6,005	0.99	5,257	3,500	2,500
5	5⅝	0.258	5.05	26,669	1.54	8,134	1.35	7,121	3,050	2,200
6	6⅝	0.280	6.56	34,616	2.03	10,731	1.82	9,588	2,800	2,050
8	8⅝	0.277	8.54	45,107	2.64	13,983	2.37	12,495	2,100	1,550
8	8⅝	0.322	9.87	52,098	3.06	16,150	2.68	14,139	2,450	1,800
10	10¾	0.279	10.79	56,987	3.56	18,806	3.15	16,640	1,700	1,250
10	10¾	0.307	11.85	62,542	3.91	20,639	3.46	18,262	1,900	1,350
10	10¾	0.365	14.00	73,920	4.62	24,394	4.09	21,585	2,250	1,650
12	12¾	0.330	15.14	79,950	5.00	26,384	4.42	23,346	1,700	1,250

*Aluminum Co. of America price, June 28, 1948. Base price for 90,000 lb. or more †Calculated from tests made on limited number of sizes of pipe

Pipe ends are cut to a bevel, threaded, or grooved at the mill to the customer's specifications.

A variety of fittings is available for aluminum pipe and a complete line is being built up as the demand warrants. Threaded fittings are produced by several manufacturers. Tube Turns, Inc., makes aluminum welding fittings including turns, tees, flanges, and other items.

The long bends required in pipe line work can be made cold in the field on either 63S-T6 or 61S-T6 using conventional methods and equipment.

Welding Aluminum Pipe Lines

After years of development and gradual improvement, welding has become the preferred method of joining steel pipe lines. When aluminum was first considered, it was apparent that field welding was desirable and the recent introduction of the argon shielded tungsten arc method of welding made this a practical possibility. All previous methods of fusion welding of aluminum had two disadvantages: (1) a heavy flux was required which was difficult to remove, and which, if not removed, created a corrosion hazard; (2) with either gas or metal arc welding it was difficult, if not impossible, to weld on a vertical surface or overhead. Argon arc welding opened up new fields by eliminating the use of flux and by permitting welding in any position, thus making possible the production of sound circumferential joints on pipe in position.

In argon shielded tungsten arc welding the arc is drawn between the work and a tungsten electrode, which is not consumed to an appreciable extent. Argon gas, which is entirely inert, passes through a tube in the torch and is discharged through an annular opening around the tip of the tungsten electrode. The gas blankets the weld pool preventing formation of an aluminum oxide film and thus permitting uniform and smooth fusion. Filler wire, usually 95 per cent aluminum-5 per cent silicon alloy, is added by the operator as required. Cooling water must be supplied to the torch to prevent overheating and a high-frequency current is applied to stabilize the arc.

Most argon arc-welding equipment is not portable as it must be connected to water and power lines. The first portable field unit for this type of welding was built by Hobart Brothers Co., Troy, Ohio, to specifications of the Alcoa process development laboratories. This unit consists of a gasoline engine driving an alternator which supplies the welding current. To this standard equipment were added a high-frequency unit and a pump to circulate cooling water from the engine radiator. Relays to control the flow of gas and the current were also provided. The equipment in its final form is compact and portable, and has excellent performance characteristics. It was used very successfully in the installation of the test pipe lines for Interstate Oil Pipe Line Co.

The operation of this equipment under field conditions proved economical and simple. In welding, a thin ring of stainless steel is inserted at joints to form a backup and to assure smooth interior weld surfaces. The stainless-steel ring is pulled out of the pipe after the weld is completed. Indications are that this ring may be dispensed with as welding technique improves.

The operation of welding standard pipe, 3 in. and above, consists of light tacking followed by laying two weld beads. The speed of welding is quite satisfactory. Where pipe can be rotated sufficiently to eliminate overhead welding, a weld on 4-in. pipe is completed in about 8 minutes, and on 6-in. pipe in about 15 minutes.

(Continued on page 301)

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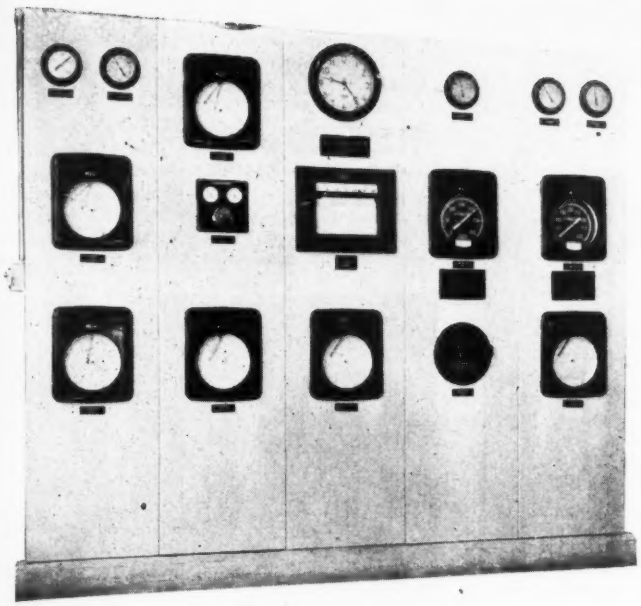


Panel board at Eunice field compressor station

INSTRUMENTATION

On El Paso Natural's Texas-California Line

by E. L. Stark*

EL PASO NATURAL GAS CO. now has in operation most of its main-line and field compressor stations in the Texas-California project for delivering gas to the pipe-line system of Southern California Gas Co. and Southern Counties Gas Co. at the Arizona-California border. The principal objective in the design of this transmission system was to assure continuity of operation, and, to obtain this successfully and economically, a further study of automatic control of compressor stations was desirable. Useful data were available, acquired over a period of several years' operation of compressor stations on its Texas, New Mexico, and Arizona transmission systems.

El Paso Natural Gas Co.'s engineers have for many years included in the design of compressor stations, automatic control of jacket-water and engine-oil temperatures. Although the design of the cooling water system in the older plants was decidedly different from the systems employed on the Texas-California project, the control of jacket water and oil cooling in the earlier units proved conclusively that the additional capital expenditure was justified.

It is interesting to compare the recording and controlling instruments employed in the operation of the present-day compressor stations with those the industry has used in past years. Many of the earlier installations were equipped with only stem-type thermometers which indicated gas-input temperatures and gas-discharge temperatures, indicating pressure gages for suction and discharge pressures, and control of jacket-water temperature either manually or with simple self-actuated types of controllers.

Instrumentation of El Paso Natural's new compressor stations includes such important controls as: control of compressor discharge pressure by controlling engine speeds, determination of engine r.p.m. by use of an electronic multipoint speed indicator, temperature records of gas to and from compressors, a multipoint electronic temperature indicator for measurements at various points, and other miscellaneous instruments. Fig. 1 of the Jal No. 1 main line compressor station and Fig. 2 of the Eunice field compressor station, together with their corresponding photographs, show representative panel layouts of new stations. Not shown in these photographs are indicating flow meters, the function of which is to check the distribution of cooling water to oil coolers and compressor jackets. Another set of meters is similarly used to balance the return water to the cell of the cooling tower.

The applications of some of the newer type instruments for compressor stations are as follows:

R.p.m. Indication

A Dynalog electronic engine speed indicator is shown as instrument No. 11 in Fig. 1 and No. 12 in Fig. 2. The primary or measuring element for this instrument is a generator per-

1—Input suction pressure. 2—Input discharge pressure. 3—Starting air pressure. 4—Clock. 5—Main-line suction pressure. 6—Main-line discharge pressure. 7—Engine jacket water pressure. 8—Oil cooling water pressure. 9—Engine-fuel control. 10—Multipoint temperature recorder. 11—Dynalog multipoint speed indicator. 12—M/40 Dynalog temperature controller—engine jacket water. 13—Compressor fuel orifice meter. 14—Well input discharge controller. 15—Main-line discharge pressure controller. 16—M/40 Temperature controller—oil cooling and compressor jacket water

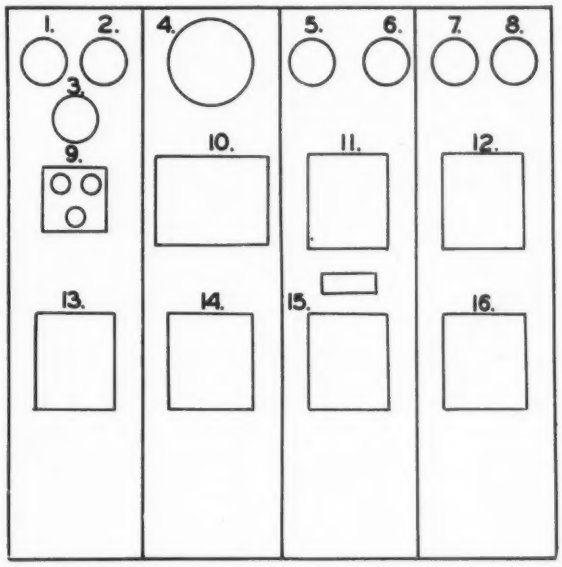


Fig. 1—Panel layout of Jal No. 1 main-line compressor station

*Dallas district manager, the Foxboro Co., Foxboro, Mass.

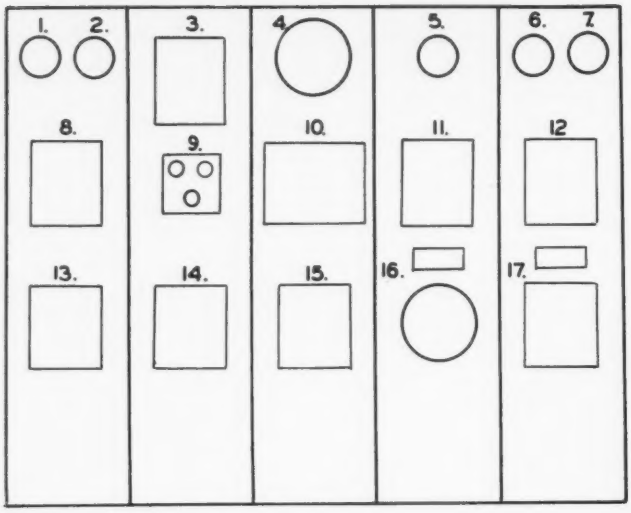
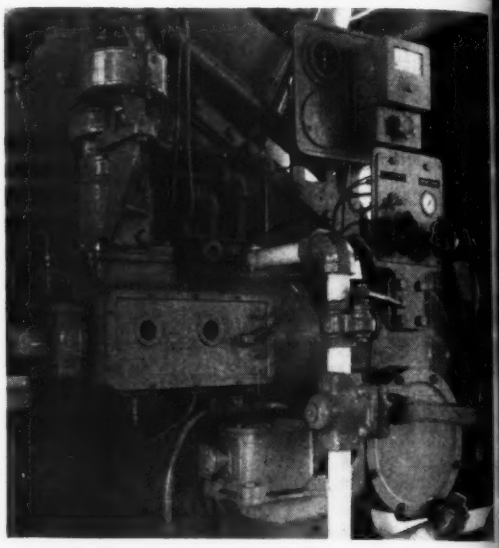
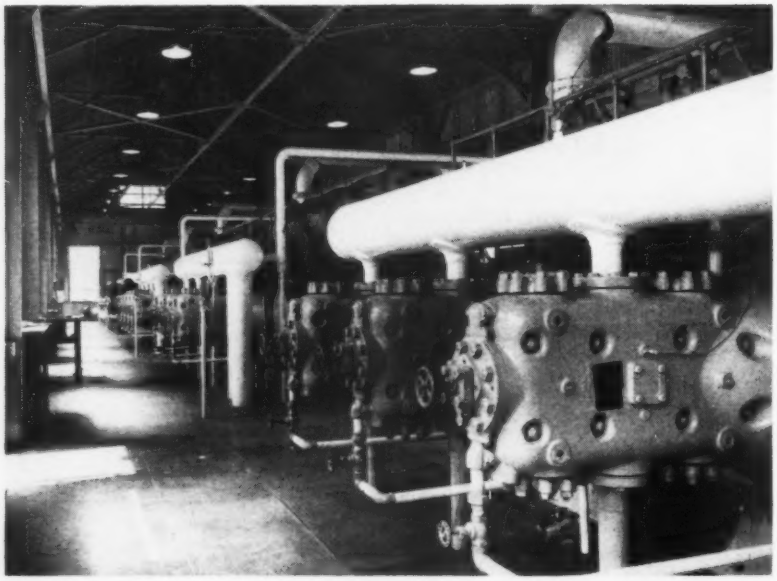


Fig. 2—(Left) Panel layout of Eunice field compressor station. 1—Second-stage discharge. 2—First-stage suction. 3—First-stage suction and discharge pressure recorder. 4—Clock. 5—Starting air pressure. 6—Jacket water pressure. 7—Oil cooling-water pressure. 8—Second-stage suction and discharge pressure recorder. 9—Engine-fuel control. 10—Multipoint temperature recorder. 11—Dynalog multipoint temperature indicator. 12—Dynalog multipoint speed indicator. 13—Gas flow meter. 14—Gas flow meter. 15—M/40 Dynalog temperature controller—engine jacket water. 16—Rotax controller—engine jacket water. 17—M/40 Dynalog temperature controller—oil cooling and water compressor jacket water



Right: Detail of engine governor and panel for manual operation

Below: Compressor end of a typical station



manently attached to the engine shaft; and since this is a multipoint instrument, one generator is attached to each engine. The voltage output from the generators is proportional to engine speeds. For instance, at 1,000 r.p.m., the output voltage is 6 volts on open circuit and the internal resistance of the measuring circuit is 20 ohms.

It will be observed that toggle switches are provided in order that the speed of any engine may be read on the indicating instrument by the operation of its respective switch. The design of this electronic-type instrument does not employ the use of a slide wire to balance the bridge; neither does it incorporate the use of a galvanometer. Although vibration at the panel has been reduced to a minimum it is obvious that vibration will not affect an instrument which incorporates such a design.

Discharge-Pressure Control

Instrument No. 15, in Fig. 1, is a Stabilog pressure recorder-controller which controls the pressure in the discharge header by simultaneously setting the individual engine speed governors pneumatically by means of diaphragm motors. This instrument records and controls the discharge pressure from the compressors, with the pressure tap in the discharge header. The point at which the pressure is to be controlled is set manually by an index in the instrument. When the discharge pressure reaches this predetermined value the controller will have adjusted the air pressure to the diaphragm motors on each engine governor so that the engine speed will be that necessary to maintain the discharge pressure.

Since the suction header pressure and the discharge header pressure are common to all compressors, the work performed by each engine should be approximately the same, provided the mechanical efficiency of each is equal. This uniformity of operation may easily be detected by the Dynalog multipoint speed indicator which will show immediately any change in the engine speed. The advantage of this speed-control system lies in the fact that one or more engines may be controlled simultaneously by one master controller, and in the event it is necessary to take a unit out of operation, the controller will automatically increase the speed of the remaining units to compensate for the deficiency created by the removal of the unit.

Greater stability of operation can be maintained for the reason that the controller adjusts the speed when it is necessary to compensate for variable operating conditions. Since close control of the discharge pressure is desired, the function of automatic re-

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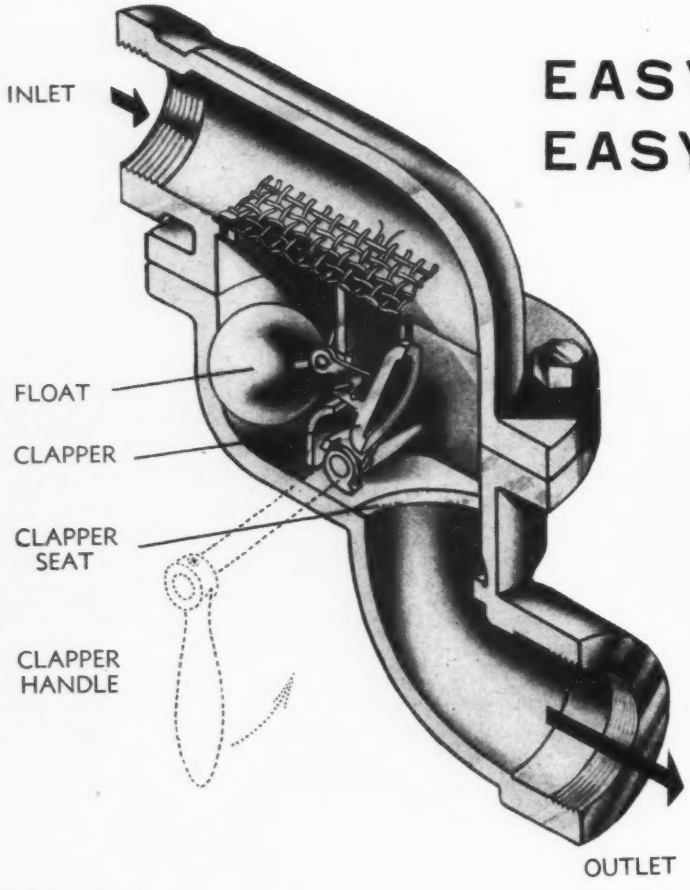

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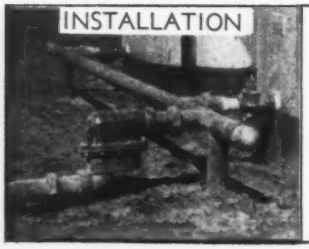

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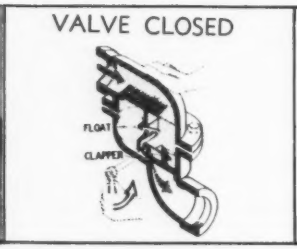
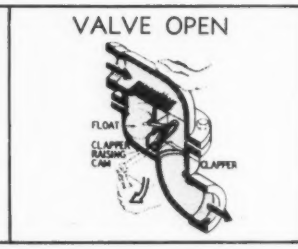
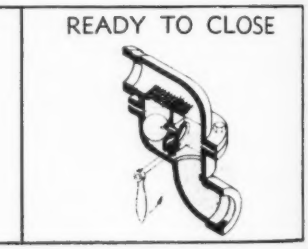


No oil flows through until you open the valve.



When the "Seco." is opened, oil flows freely through. . . . No volume losses.



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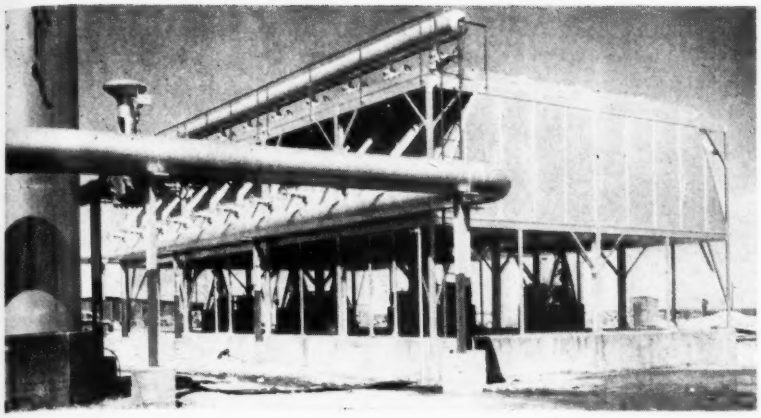


Engine jacket water cooler

set is incorporated in the instrument control mechanism. A subpanel assembly is an integral part of each controller and provides for automatic, manual and service positions. This assembly offers a convenient way of starting operation and simplifies operations in the event that it is necessary to control manually or to service the instrument.

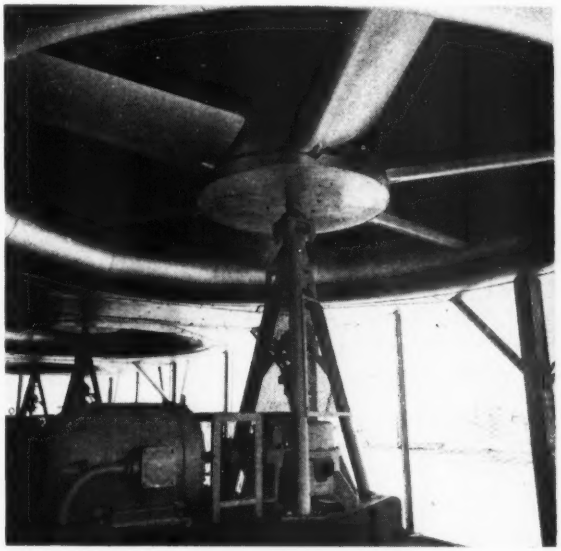
In addition to these operating features the engine manufacturers have provided a pneumatic manual operating panel for each engine with which it is possible to control manually any individual engine at a speed slower than the others which are being controlled automatically.

Engine Jacket-Water-Temperature Control

Engine jacket-water temperature is controlled automatically and closely by an electronic Dynalog controller, which is instrument No. 15, in Fig. 2. This application is basically one of transferring sensible heat from a hot-water stream to a cooler stream, with the control valve installed in a line bypassing the cooler and with the temperature measuring element (resistance bulb) located in the return line from the cooler at a point downstream from the point of entry of the hot-water bypass line.

In a closed system of this type, principal control is obtained by means of a control valve in a line bypassing the cooler. However, this alone will not handle the wide variations in load due to changes from winter to summer conditions, and it is therefore necessary to cut in or cut out fans to meet these conditions. By automatically sequencing and interlocking the fan motors with the bypass control valve, the system will automatically take care of load variations with no manual assistance. A control system to do this is shown in Fig. 3. It was worked out by John Eichlemann, chief engineer, and C. L. Moore, assistant chief engineer, for El Paso Natural Gas Co., and the writer.

A Rotax indicating pressure controller is connected to the air line from the temperature controller to the control valve and operated from the pressure in this line which, of course, is the pressure on the diaphragm of the control valve. The Rotax controller, however, is electrical in operation since its function on this application is to shut down and start electric motor-driven fans. As the pressure-measuring element moves the indicating pointer, commutator-type contacts are rotated toward or away from contact brushes, thus successively closing and opening electric relay coil circuits, thereby starting or shutting down the motor-driven fans.



Fan detail of engine jacket water cooler

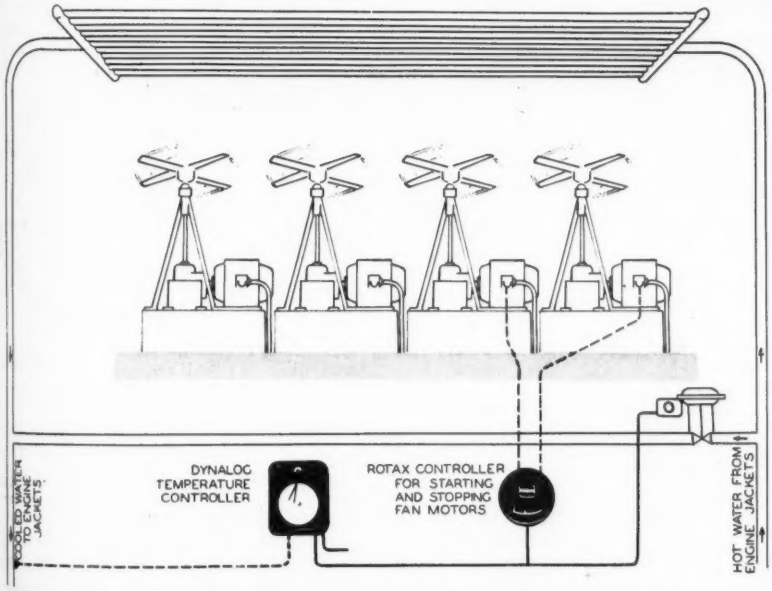


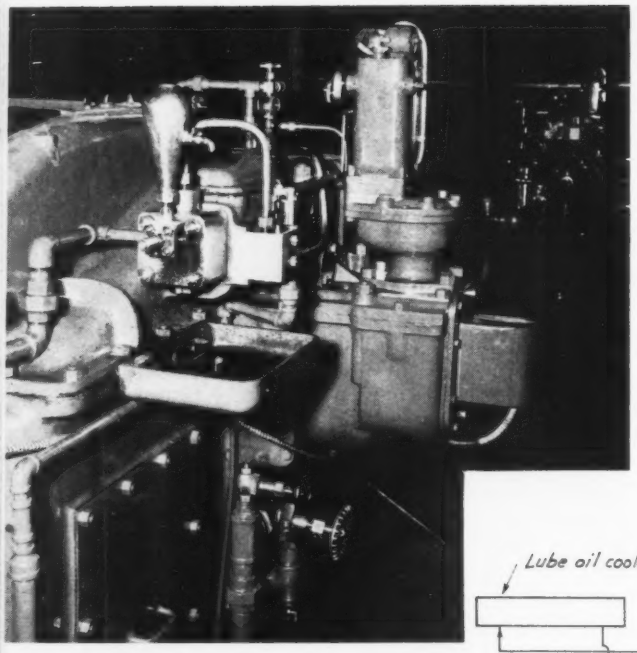
Fig. 3—Control system worked out by the author and others to handle wide variations in load due to changes from winter to summer conditions

The valve action of the pneumatic temperature controller is air-to-close; therefore, when the air pressure to the valve approaches zero pressure, the valve is nearly wide open. This would indicate that with all fans in operation too much cooling water is being maintained, necessitating that a large volume of hot water be bypassed through the control valve in order to maintain the desired jacket water temperature. When this condition is reached, one of the fans

(Continued on page 307)

Features of a modern DIESEL-PUMP STATION

by Fred H. Warren



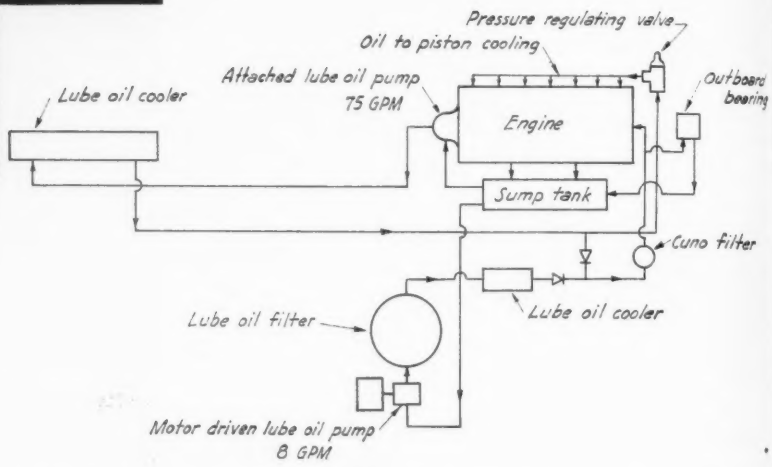


Fig. 1—(Above) View showing fuel-injection pump, fuel bypass valve, and governor
Fig. 2—(Right) Diagram of engine lube-oil system at Martinsville station

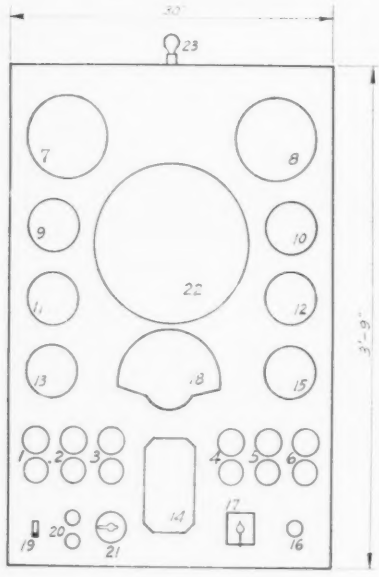


Fig. 3—Diagram of central control panel. KEY: (1) Lubricating-oil pressure. (2) Water temperature. (3) Water-supply failure. (4) Low suction pressure—5 lb. (5) Low suction pressure—0 lb. (6) Signals. (7) Line pressure (discharge). (8) Line pressure (suction). (9) Engine lubricating-oil pump. (10) Auxiliary oil-filter pump. (11) Forced lubrication. (12) Fuel pump. (13) Fuel supply to engine. (14) Pyrometer. (15) Water pressure. (16) Engine shutdown button. (17) Governor switch. (18) Tachometer. (19) Board supply switch, 110 U.A.C. (20) Auxiliary lubricating-oil pump. (21) Signals mark-time switch. (22) Flowmeter. (23) Pilot light

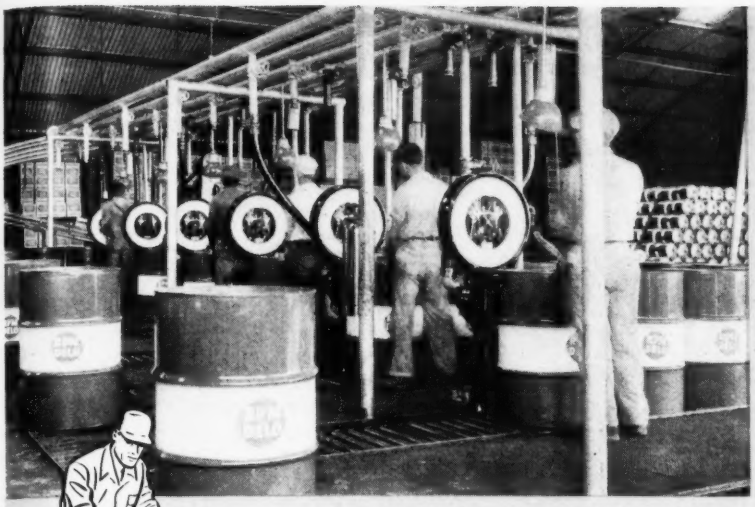
ONE of the first modernizing jobs undertaken by the pipe line department of Ohio Oil Co. at the close of World War II was replacing the steam station at Martinsville, Ill., erected in 1906, with a modern diesel station.

The original station site was not suitable for the diesel station because of unsatisfactory subsoil conditions and occasional floods. A site for the new station was selected approximately 300 ft. west of the old station at an elevation some 40 ft. above the old station.

In order to maintain ample suction pressure on the discharge pumps it is necessary that all oil handled by this station be picked up by booster pumps and discharged into the main suction manifold. Four booster pumps were installed for this purpose. Two booster pumps along with a large-capacity, low-pressure reciprocating suction pump are located in a booster pump house near the old station. The other two are located in a pump house immediately south of the new station and at an elevation approximately 10 ft. lower. Three of the pumps are driven by 60-hp. motors and the fourth is driven by a 75-hp. motor. The efficiency of the booster pumps over their operating range exceeds 80 per cent. Any two booster pumps have ample capacity for maximum station throughput.

F. H. Warren is general superintendent of trunk and gathering-line operations east of the Mississippi River, for the pipe-line department of Ohio Oil Co., Findlay, Ohio. Following graduation from Iowa State College in 1925, with a B.S. degree in mechanical engineering, he joined Ingersoll-Rand Co., remaining for 14 years, when he was appointed assistant chief engineer of Ohio Oil's pipe-line department. He served during the war with PAW's supply and transportation division.

The main pump station building is 70 by 80 ft., steel-frame construction, with corrugated asbestos sides and roof. A fireproof wall divides the building into a pump room and an engine room. A lean-to extends across one end to provide offices and storage space for lubricating oil and supplies. A 15-ton hand-operated crane and a 2-ton electric crane travel the



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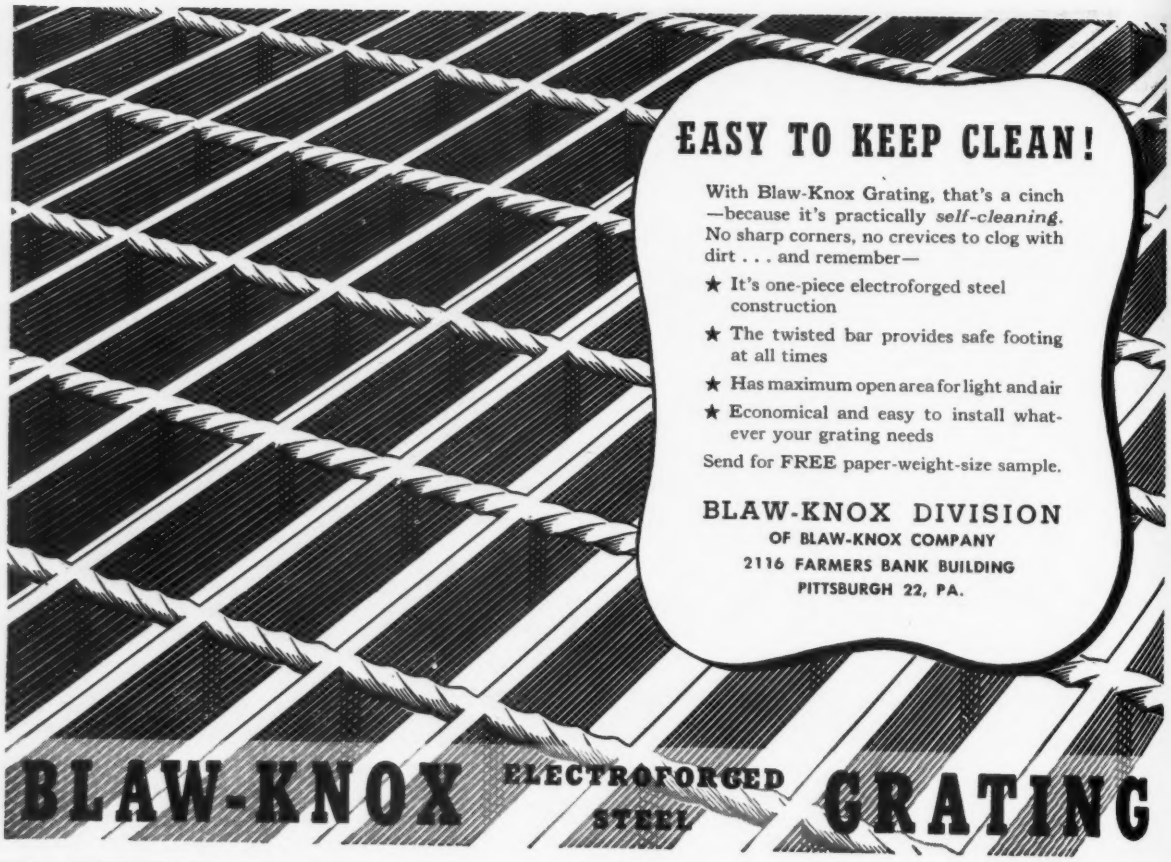

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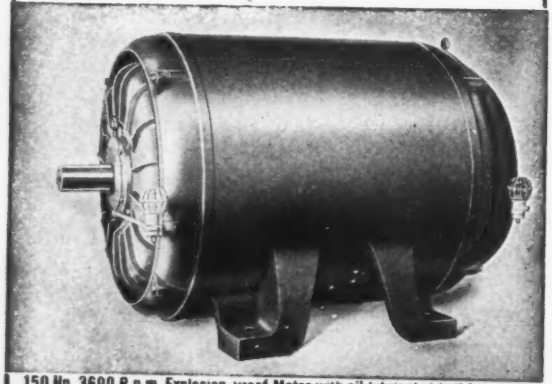

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full length of the engine room. A 5-ton hand-operated crane is installed in the pump room. The engine room is heated by radiation from the engines. The pump room and storage room are heated by unit heaters. The engineers' offices are heated by cast-iron radiation, and the locker room by a wrought-iron coil imbedded in the floor. Heat is obtained from the engine jacket water.

In addition to the booster pump load, the division machine shop located at Martinsville has a peak demand of approximately 50 kw. Other auxiliaries bring the total electric demand up to approximately 150 kw. In order to make the station independent of an outside source of power, except for starting up, and to keep the operating cost to a minimum, it was decided that 250-kw., 8-power factor, 480-volt, 3-phase, 60-cycle a.c. generators should be direct connected to two of the main engines. Alternators of 225 r.p.m. were selected because all three engines are not required to operate at full speed of 240 r.p.m. even at maximum line capacity.

Three Discharge Pumps

Three identical six-stage centrifugal discharge pumps are installed in the new Martinsville station, each designed for a capacity of 65,000 bbl. per day against 800 lb. total head when operating at 3,150 r.p.m. which corresponds to an engine speed of 240 r.p.m. At rated capacity approximately 5 lb. pressure is required at the pump suction. The pumps are equipped with nitralloy shaft sleeves, and are packed with Rhoades metallic packing. Spherically seated, babbitt-lined bearings are used with a center-collar Kinsbury thrust bearing at the outboard end of the pump. The bearings are pressure lubricated from an attached oil pump. The pumps are driven through Sykes tooth double-stepup gears.

Here prime movers are seven-cylinder, 19½ by 28 crude-oil-burning four-cycle diesel engines, rated 1,330 hp. at 240 r.p.m., nonsupercharged. The engines are equipped with Price heads and operate with a compression pressure of approximately 380 psi. One fuel pump actuated by a seven-point cam mounted on the overhead cam shaft, and one bypass valve supply fuel to all seven cylinders. Fig. 1 shows the complete fuel system and governor with the exception of the distributor and the injection valves. The reliability and simplicity of the fuel system are important features of this installation. The engines are equipped with oil-cooled pistons and water-cooled exhaust valves.

The lubricating-oil flow diagram is shown in Fig. 2. Lubricating oil drains from the engine base into an external sump. An attached lubricating-oil pump takes the oil from the sump and discharges it to the lubricating-

(Continued on page 308)

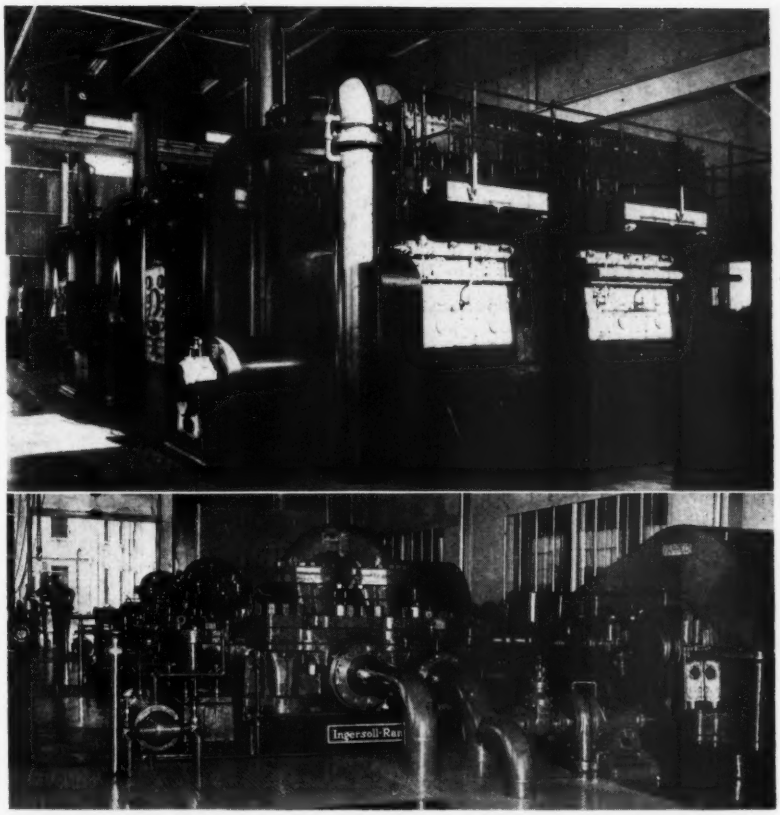
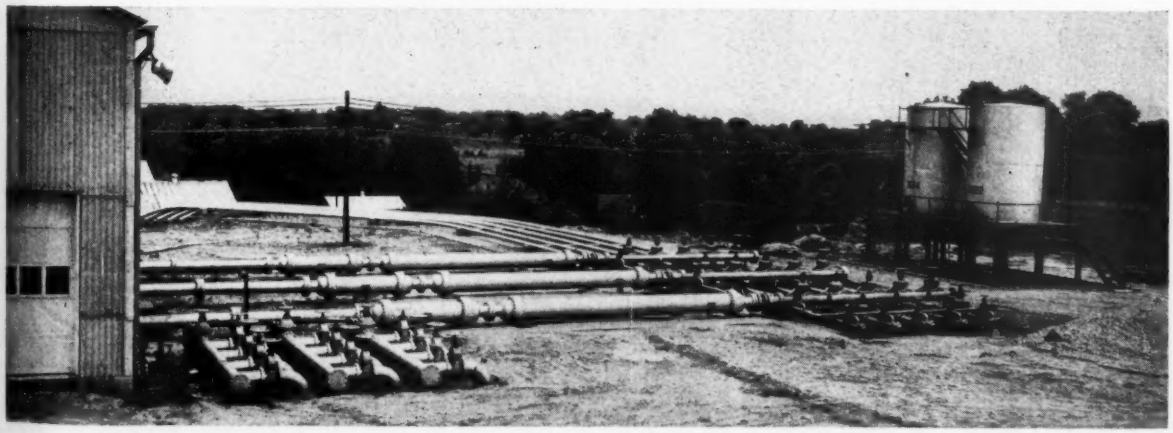


Fig. 4—(Top of page) View of the engine room. Fig. 5—(Immediately above) Pump room viewed from Unit No. 1. Small pump in foreground circulates the engine jacket water

Fig. 6—The oil piping and fuel tanks. The suction manifold is in the left foreground and discharge at the right. In each discharge line there is installed a flow-meter orifice approximately 12 ft. out from the building, then a lube-oil cooler, a jacket water cooler with an expansion joint adjacent to the discharge manifold. The heat exchangers are supported on rollers



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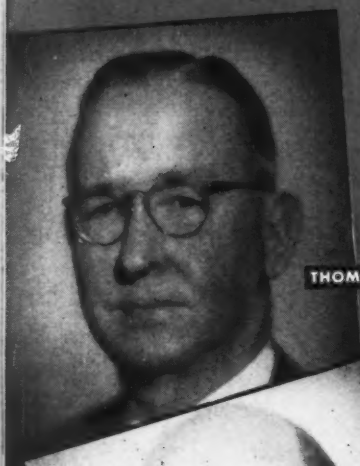

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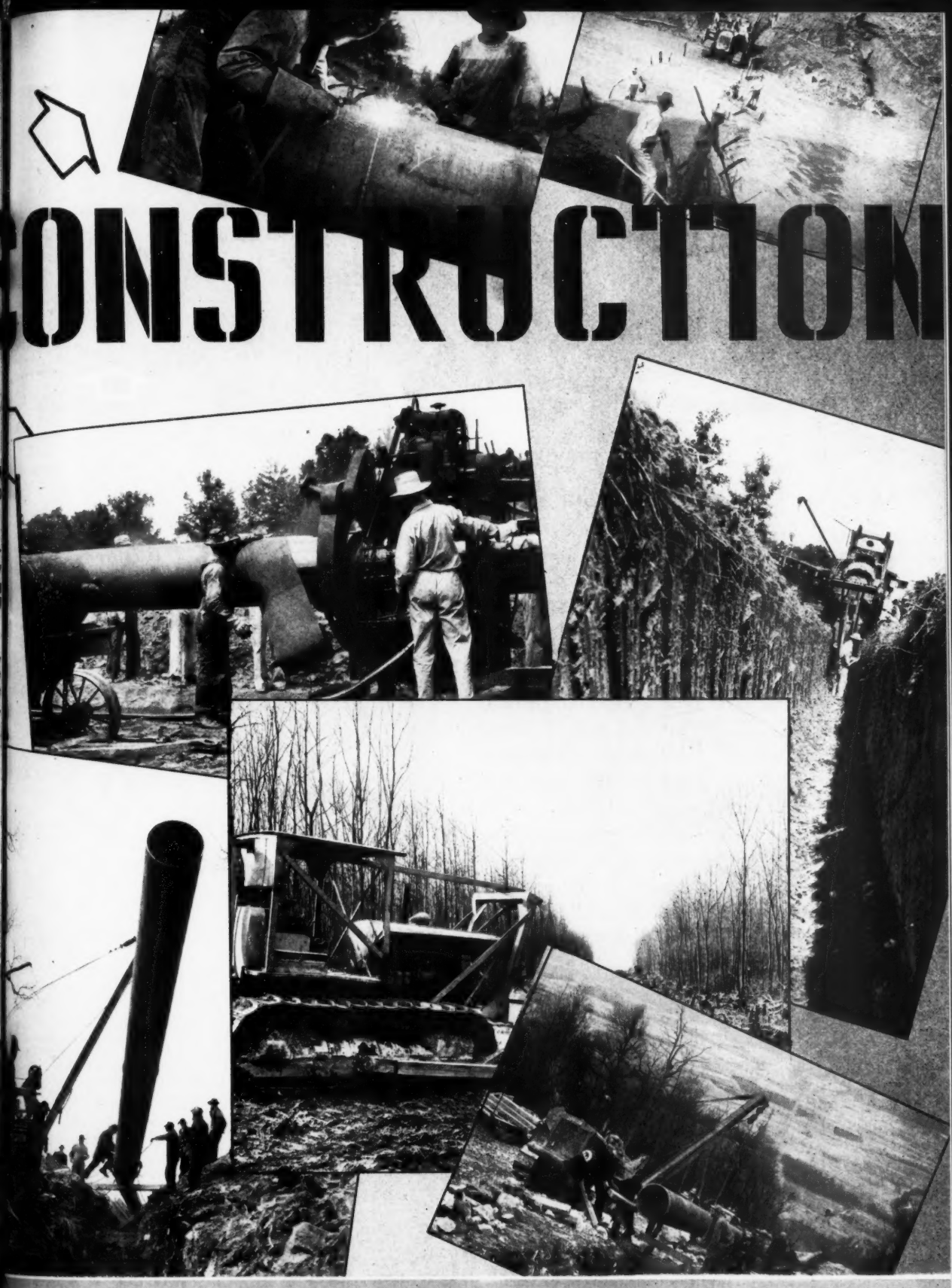
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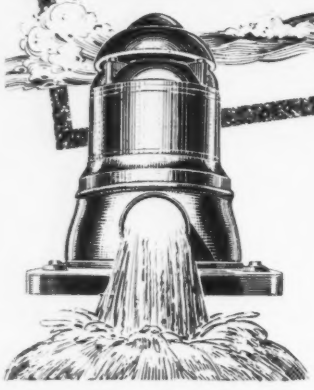

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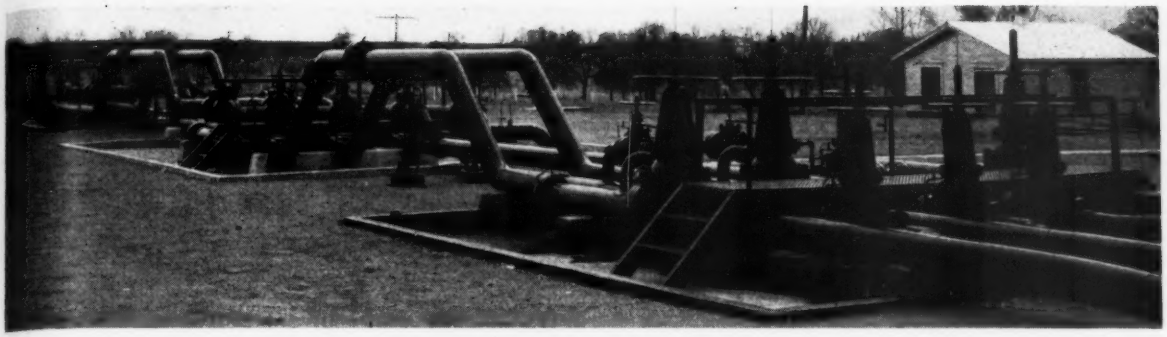


General view of manifold at Grandview pump station

Aboveground Welded Manifolds On Gulf's West Texas System

by H. A. Johns*

WHEN Gulf Refining Co.'s pipe-line receipts of sweet crude oil in the West Texas area had increased to a sufficient volume, it was decided to set aside a single 10-in. line out of the trunk-line system, from Midland to Lufkin stations, through which to block sweet crude oil with the least amount of intermixing with sour crude oil. This single line is operated as a closed system between the following terminal points: Midland, Ranger, Wortham, and Lufkin. The remainder of the trunk line system from Midland to Lufkin transports sour crude oil only.

Among the additions and changes required at this time were new incoming and outgoing welded manifolds at all intermediate stations. The manifold in the diagram is typical of these installations. These manifolds were all arranged for either in-and-out or through pumping; they are constructed aboveground on concrete piers to eliminate external corrosion and simplify maintenance and future extensions.

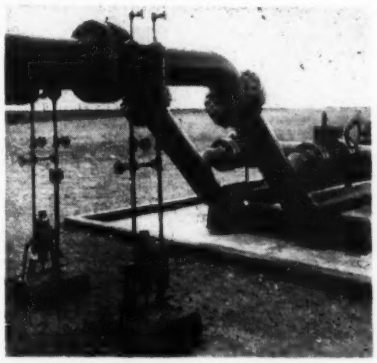
Larger I.D. Barrels

Incoming and outgoing scraper traps have slightly larger inside-diameter barrels with a special Unibolt coupling and blanking plug. A special combination strainer and scraper trap was used on the incoming line on the closed system. This, together with the valve arrangement, provided for a quick, clean, and easy method of putting in and taking out a swab or scraper without shutting down a line.

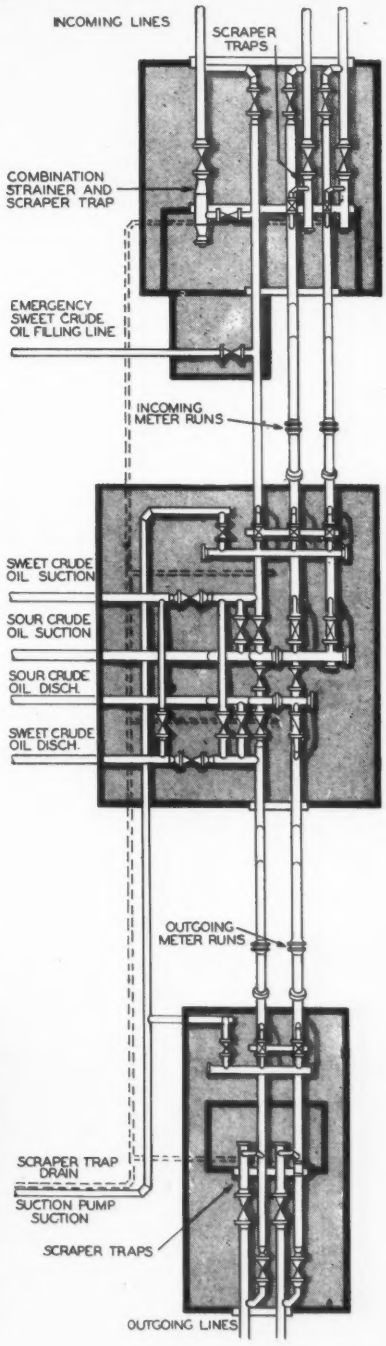
Electric recording flow meters were installed on all incoming and outgoing lines except the incoming line on the closed system. The use of recording meters and pressure gages provides a quick indication of either line or station trouble whenever it develops.

A suction-pump suction connection was provided to all incoming and outgoing main lines to take care of line trouble. Manually operated double-disk gate valves and plug valves with flanged ends were used as required throughout. All gate-valve bonnets and idle headers have small valves for sun pressure relief. Steel walkways and steps were provided for all valves not convenient to operate from the ground level. Thermometers and sampling connections were installed on all incoming lines.

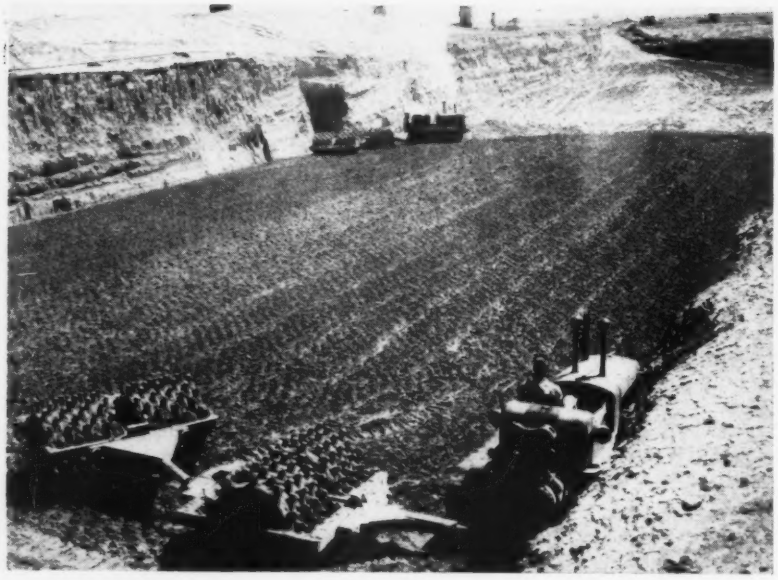
All fabrication and testing of these manifolds were done in Gulf's shops in Beaumont, Tex.



Above: Typical meter runs in connection with manifold. Right: Diagram of typical welded manifold for crude-oil manifold



*Assistant chief engineer, Gulf Refining Co., Houston Pipe Line Division



South end of main engine excavation, showing refilling and compacting

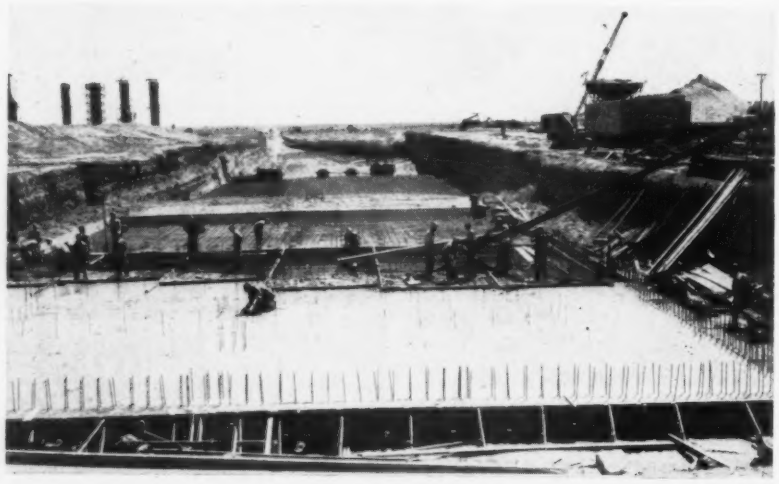
Cities Service Gas Compacts Soil To Form Base for Heavy Engine Foundations in Hugoton Field

by Russel W. Hofsess

DESIGNING the foundations and finding a suitable load-bearing formation on which to base them was one of the major engineering problems faced by Cities Service Gas Co. in the design and construction of its new 30,000-hp. compressor station in Hugoton gas field in Grant County, Kansas.

This station is being constructed to compress gas from field pressure to 900 psi. into the new 26-in. pipe line being built from Kansas Hugoton field to Kansas City. The initial station installation will consist of eleven 1,600-hp. Cooper-Bessemer horizontal-type gas-engine-driven compressors with the necessary auxiliary gas-engine-driven generating equipment to furnish electricity for plant operations, and a gas dehydrating plant on the discharge of the station. It is planned that the plant will be enlarged as needed by the addition of eight 1,600-hp. engines.

Main engine excavation with refilling, compacting, and pouring of the 24-in. concrete mat in progress



Russel W. Hofsess is operating engineer for Cities Service Gas Co., located in the Oklahoma City office. He graduated from Kansas State College at Manhattan in 1929 with a B.S. degree in civil engineering, and has been with the Cities Service Gas Co. since 1933 in jobs from field timekeeper through superintendent of pipe-line department, assistant superintendent of operations, and operating engineer. During the war he served 5 years as an anti-aircraft artillery officer in the Army, the last 18 months in the European theater with the rank of lieutenant colonel.

Ultimate plans call for installing the nineteen 1,600-hp. engines in a single line in a building 74 ft. wide by 630 ft. long, over a full basement approximately 10 ft. deep.

The site of the compressor station was fixed within a limited area by the location of available gas. A suitable site, from a surface standpoint, within this area was selected and tests started to determine the type of foundations necessary to support equipment of the size and weight to be installed.

With full reinforced-concrete mats under all structures, foundation-bearing loads were calculated to be approximately 1,100 lb. per square foot under the main engines, 800 under the auxiliary engines, and 1,500 under the dehydration contactor towers.

The first soil-bearing tests were made by boring 8-in. holes to a depth of 11 or 12 ft., and placing increasing loads on a pedestal extending to the bottom of the hole, and observing settlement as the load was increased. An area of several hundred square feet was gridded off and bearing tests made over the area. The soil in the test holes bored was found to be generally uniform over the area, but load-bearing characteristics varied considerably and appeared to be affected greatly by the moisture content. It was decided from these preliminary tests that there was a serious

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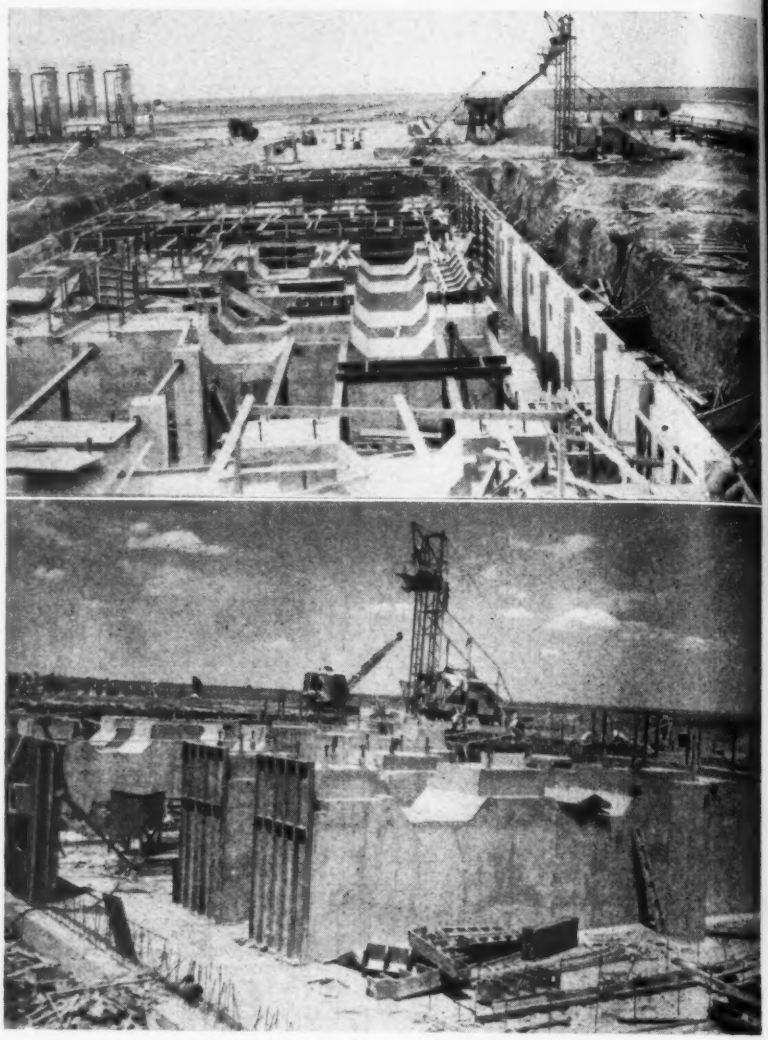
foundation problem and extensive tests and analyses should be made to insure a stable foundation.

A core-sampling rig was moved to the location and 2½-in. dry cores were taken at the proposed site of the main engine foundations, and on a circle around this location, on a radius of approximately 300 ft. These dry cores were taken to varying depths from 27 ft. down to 57 ft.

Four wash borings were made in the area of the main building to a depth varying from 165 to 207 ft., and a 6 by 6-ft. square shaft was sunk in the center of the area to a depth of 50 ft. to enable the taking of undisturbed samples to that depth. Samples from the dry cores, the wash borings, and the undisturbed samples from the excavation were taken to the laboratory to classify the material and provide a basis for determining supporting capacity. The dry core samples showed that the layers of different materials were comparatively uniform over the area and laboratory tests were made primarily on undisturbed samples from the shaft excavation. These were made on the samples for moisture content, density, specific gravity, void ratio, grain size, consolidation, shear resistance, and confined and unconfined compressive strength.

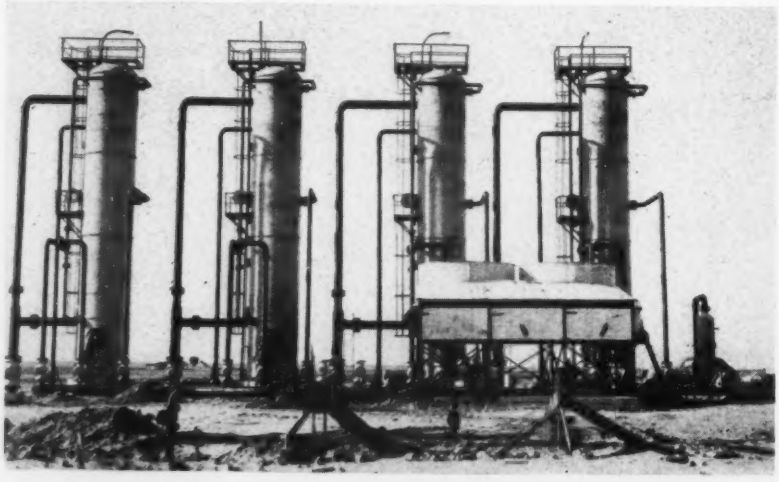
The upper strata down to a depth of approximately 22 ft. proved to be fine sand and silt, relatively loose and unconsolidated and, in some cases, the grain structure was of a cellular arrangement that would break down suddenly under a vibrating load. It was definitely decided that this first 22 ft. was not composed of suitable material on which to base the foundations.

For a depth of some 20 to 37 ft. below the 22-ft. layer, the stratum proved to be the same fine sand and silt, but with calcium carbonate inclusions, which had apparently weathered and diffused through the sand and cemented it into a stable, well-consolidated soft sandstone-like material. Tests indicated that this stratum was suitable for carrying non-vibrating loads up to 10 tons per square foot, and vibrating loads, such as the main engine and auxiliary engine foundations, up to 3 or 4 tons per square foot. The wash borings indicated the material below the hard sand stratum down to a depth of 150 ft. was sand and gravel.



Construction views of the main engine foundations

View of the dehydration contactor towers



Therefore, it was decided that the foundations for all three of the main structures should be based on the hard sand stratum at approximately the 22-ft. level.

The preliminary design of the main engine building and the auxiliary engine building provided for basements approximately 10 ft. deep with continuous reinforced concrete mats at the basement floor level to support the engine and building foundations. The method of projecting the foundation load on down to the hard cemented sand stratum at the 22-ft. level was the primary problem to be solved. Several methods were considered including, (1) the driving of piling; (2) excavating down to the 22-ft. level and pouring the concrete

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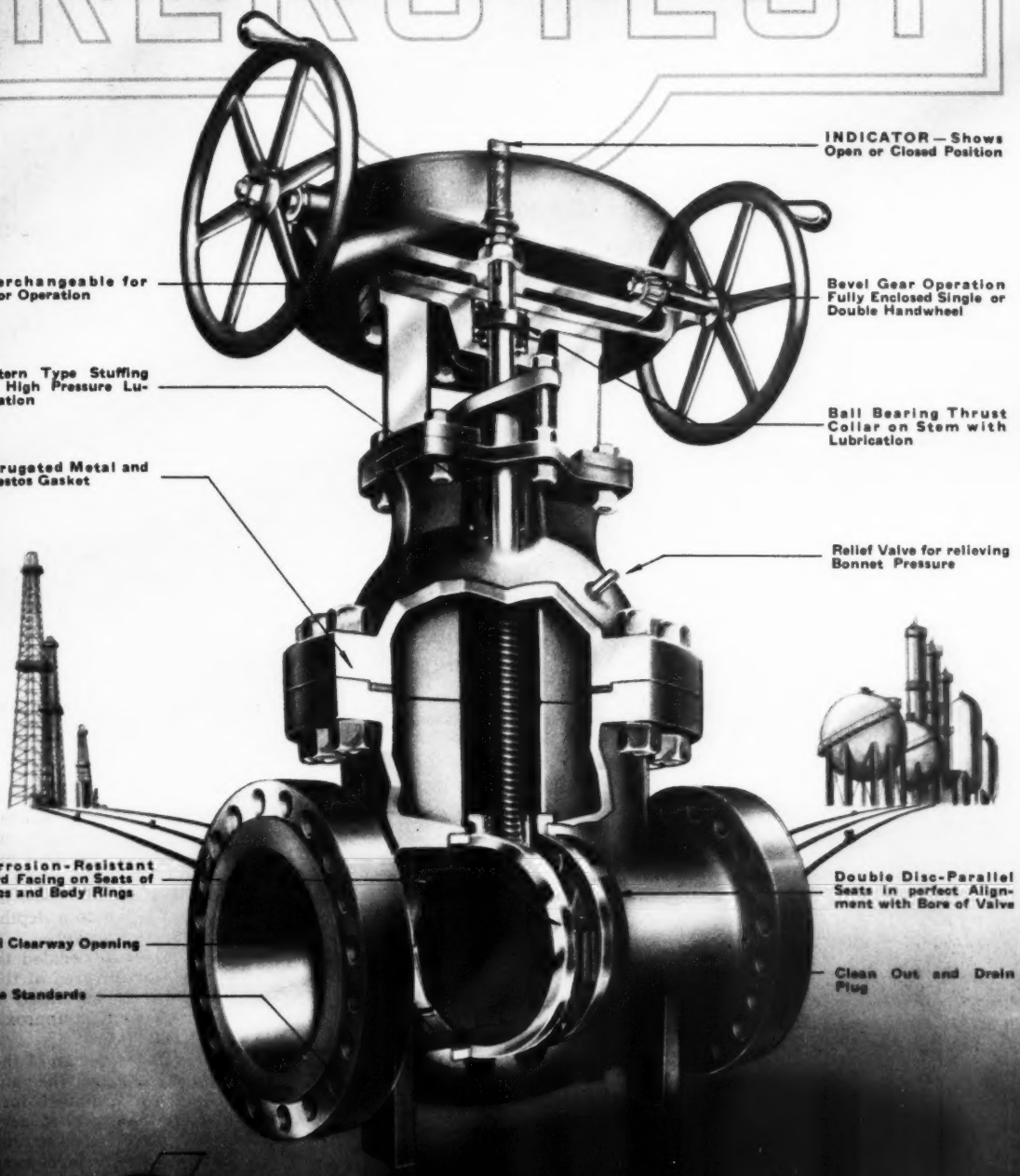
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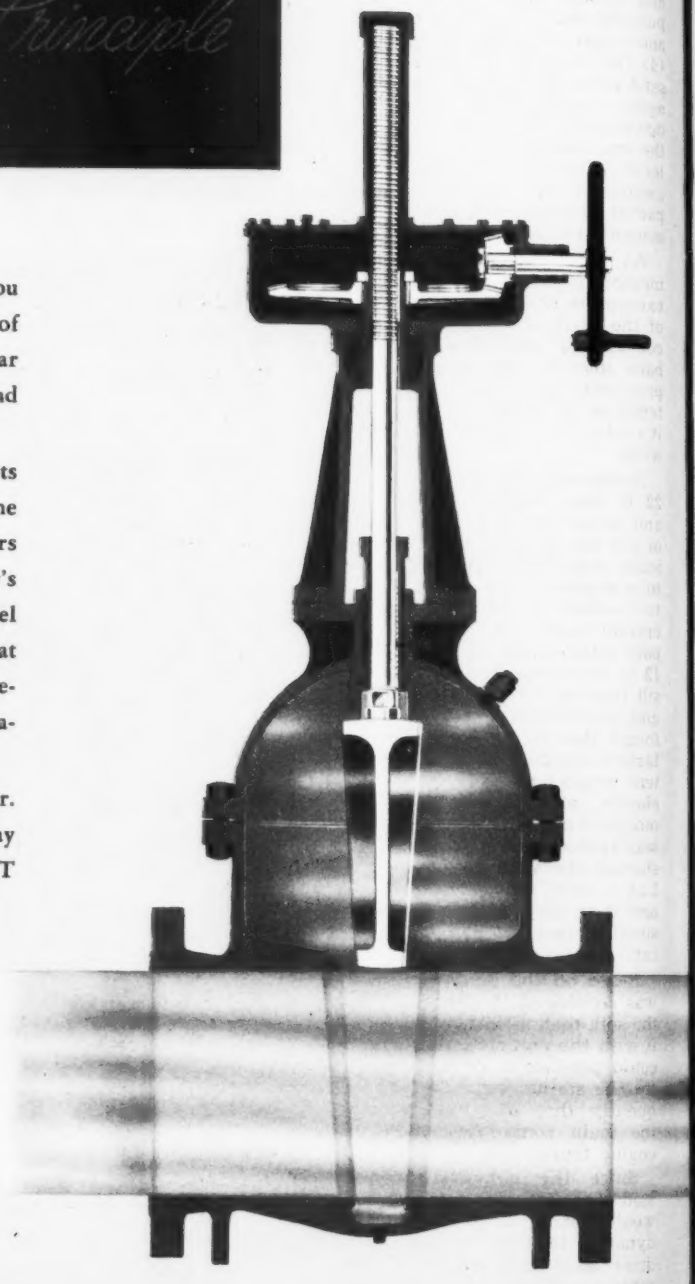

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KEROTEST FIRST NAME IN QUALITY VALVES

mat at that level, and extending the engine foundations down to the mat, then back-filling up to the basement floor level and pouring a basement floor; (3) excavating down to the 11-ft. level, then digging a series of trenches around and across the area, and filling them with gravel to be pumped full of grout after the mat and engine foundations were poured; (4) the chemical solidification of the sand strata by injection of solidifying agents into it; and (5) by excavating down to the 22-ft. level, then refilling the excavation back up to the 11-ft. level with the soil that had been excavated, with the refill being compacted to such a degree that it would support the foundations.

An economic study of the above methods favored method No. 5, i.e. the excavation down to the hard stratum of the 22-ft. level, then refilling and compacting the excavated material back into the excavation up to the proposed mat level, provided the material to be excavated was such that it could be compacted without excess work.

Additional samples from the upper 22 ft. were taken to the laboratory and tests run to determine whether or not the material could be economically compacted. The material down to a depth of 8 to 10 ft. was found to include considerable loam and organic matter, and would not compact satisfactorily, but the remaining 12 to 14 ft. was fine yellow sand and silt that would compact quite readily and satisfactorily. However, it was found that in order to obtain satisfactory compaction, the moisture content would have to be controlled very closely, and further, the optimum moisture content for such compaction was approximately 11 per cent. Tests showed the sand in its natural state had a void ratio of as high as 0.8, and if it were to be compacted to a suitable density the resulting void ratio should not exceed 0.4.

Based on the laboratory finding it was concluded the plan of removing the soil, then refilling and compacting it with the optimum amount of water could produce a satisfactory bearing for the station structures and consequently that plan was adopted for the main compressor and auxiliary engine foundations.

Since the dehydration contactor load was static, and the foundations would not be subject to vibration or dynamic loading, it was decided to drive steel H-beam pilings on 5-ft. centers and pour the reinforced concrete mat and foundations on the piling.

A field control laboratory was set up at the site and equipped to take samples to determine moisture content and void ratio of the soil, as it was placed back in the excavation and compacted. It was found that the material could be compacted in approximately 6-in. layers by from 15 to 20 passes of a sheep-foot roller, and samples were taken regularly over the area as each layer was brought in and compacted, to insure a solid, continous, uniform, compacted mass all the way up.

Controlling the moisture content was found to be a difficult problem and the most satisfactory means of adding moisture was found to be the sprinkling of a stock pile outside of the excavation and mixing it with a disk plow before bringing it into the excavation and spreading it for compaction. Compaction was done with tractor-drawn sheep-foot rollers.

Work was started in the fall of 1947, but was seriously delayed by the unusually severe winter and was not completed until the spring months of 1948. The principal cause of the delay was that the moisture content could not be controlled properly during the freezing weather.

The excavation, refilling, and compaction were done on both that portion of the main engine room to be built at this time, and on the future proposed extension so that at such a time as the extension is built, it will not be necessary to open up the excavation below the concrete mat level.

The excavation, refilling, and compaction have all been completed; mats, basement walls, and engine foundations poured and engines are now being set on the foundations.

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Rust-Oleum seals rustable metal surfaces against the ravages of rain, dampness, corrosive fumes, salt air, and other destructive, rust-forming conditions. It adds years of extra service to all metal—*at a material cost of less than 1-cent a square foot.* Many refineries now use Rust-Oleum because it outlasts ordinary protective materials two to ten times. Rust-Oleum can be applied over metal already rusted. It penetrates every pore of the metal surface and merges the remaining rust into the protective film — a water-tight, air proof, rust-resistant coating that does not blister, crack or peel.

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- **Rust-Oleum goes on 25% faster...covers 40% more area per gallon.**
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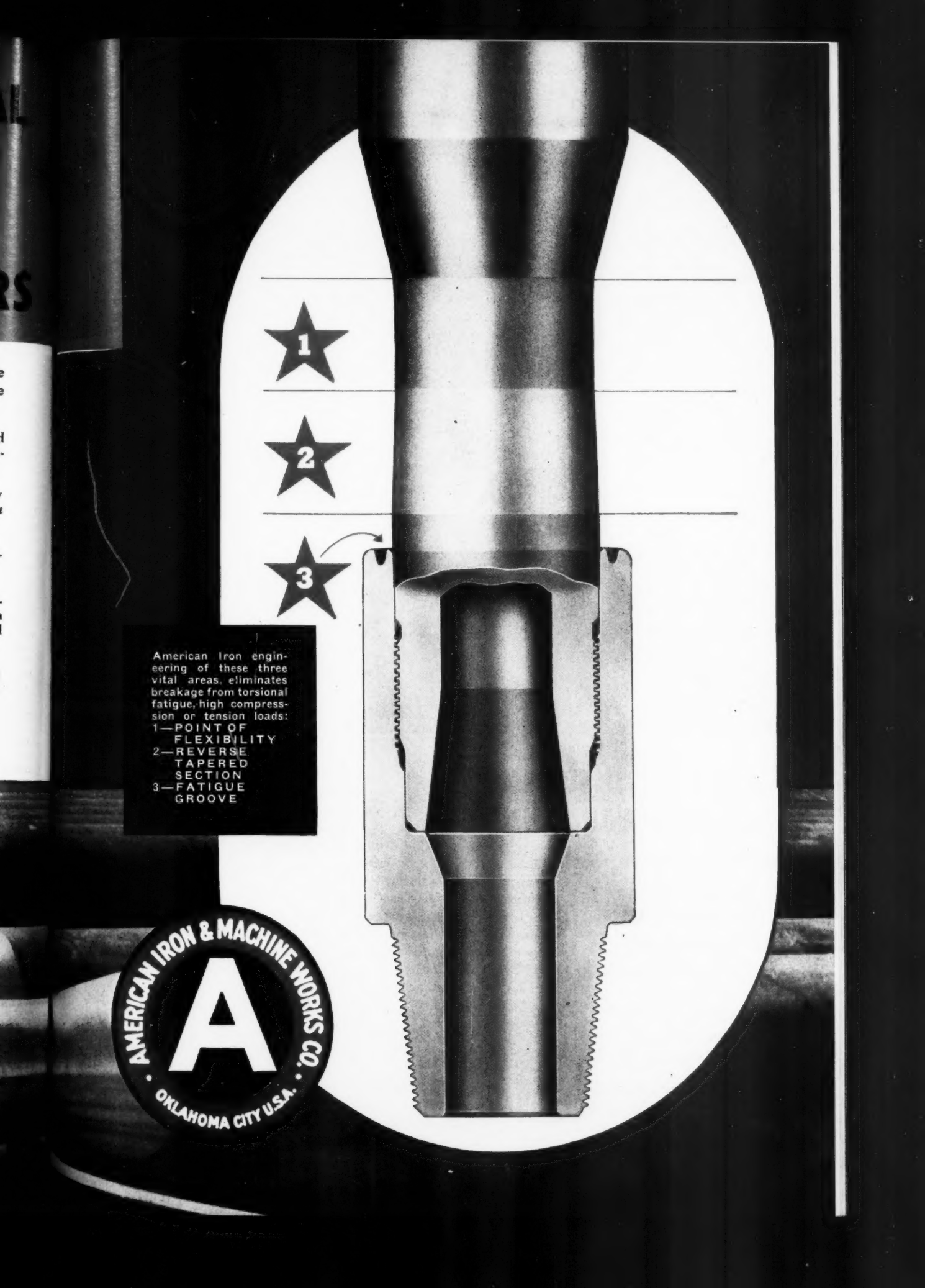
(2) REVERSE TAPERED SECTION . . . This reverse taper produces flexibility to section of drill collar a sufficient distance from *straight grip area* so as to eliminate *fatigue* breaks!

(3) FATIGUE GROOVE . . . This fatigue groove permits the face of stabilizer seal to breathe, thus eliminating pure fatigue at *critical* section.

Remember, American Iron engineering of these *three vital areas* eliminates breakage from torsional fatigue, high compression or tension loads! Also note that the tool joint O.D. is *always* the same as the drill collar!

American Iron *Straight Grip Drill Collar* Connections can be machined in any well equipped oil field machine shop, by following the simple machining and gauging practices established by American Iron Engineers. American Iron & Machine Works Co., Oklahoma City, Oklahoma — Box 1177 — Phone L. D. 518 — District Office, Houston, Texas. Export Office: 420 Lexington Ave., New York City, N. Y.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2
3
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Our special process of recessing "X-L" Quality Line Pipe Couplings assures tighter joints, better alignment, and protection of vanishing threads. They're accurately made to A.P.I. specifications —tested by Comparator to assure strict adherence to standards. Seamless and special processed—black or galvanized—in all sizes. "X-L" Couplings are used by every pipe mill in the United States and Canada; sold through all leading jobbers.

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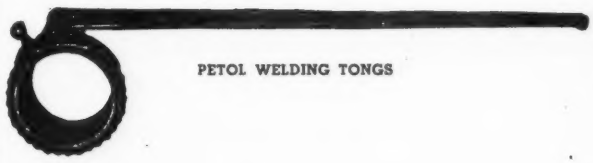
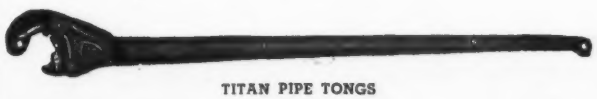

PETOL WELDING TONGS

TITAN REVERSIBLE CHAIN TONGS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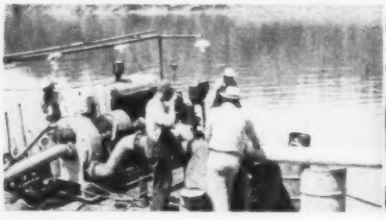
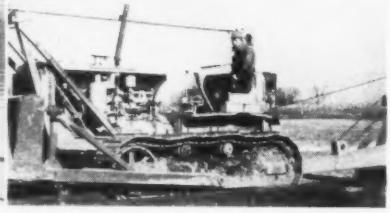
OVER THE HILLS . . . AND THROUGH THE SWAMPS





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Sinclair Pipe Line

(Continued from page 171)

will immediately shut down the motors and automatically bypass the station.

Use of electric transmission flow meters for remote recording in the control building has been standardized. These, together with recordings of pressures and specific gravities, give a continuous picture which the dispatchers and other operating personnel can interpret at any time. Starting equipment for auxiliary uses on booster pumps, sump pumps, lights, heating system, or water-well pumps is all handled within cubicles, thus streamlining the substation. The 2,300-volt bus duct runs throughout the cubicles to provide for future addition of equipment with minimum trouble. Underground conduits are bonded together and protected with magnesium anodes against electrolysis.

Cathodic protection, in conjunction with a well-coated line, is installed during the construction period. A preliminary soil-resistivity survey is made and rectifier locations are chosen prior to the line construction. The steel-pipe ground beds are installed when the pipe-line construction crews come to the selected locations. Approximately 6 tons of junk pipe are installed at each ground bed in the form of a "V" at right angles to the pipe line and at a distance of approximately 600 ft. The junk ground bed is installed in a spot of low soil resistivity in the proximity of a power line. Copper oxide and selenium rectifiers are used. On a new line a spread of approximately 40 miles can be protected with one rectifier at a very nominal current drain, depending entirely upon the perfection of the coating job.

Electrolysis test points are installed in the fence lines at approximately a mile apart and at each side of an intersection with a foreign pipe line or other structure. These test points consist of three wires bonded to the pipe and insulated at the bond. One lead is for reading pipe-to-soil potentials, the other two are spaced a predetermined distance apart, depending upon the cross-sectional area of steel in the line, so that a potential drop of 1 mv. will cause a current of 1 amp. to flow through the measured section between contact points. These leads are brought aboveground in conduit and are connected to a terminal block in a condulet box where corrosion engineers can simply unscrew the lid, clip on their instrument leads, and make simultaneous readings in their field laboratory vehicle. Periodic surveys will determine any changes in conditions and, barring human errors, should minimize corrosion troubles. Magnesium anodes are used where soil resistivities permit efficient use.

Internal corrosion is being handled by the injection of Sinclair's new

Inhibitor RD-119 which was described in the June 17, 1948, issue of The Oil and Gas Journal. The injection of this chemical at the source protects the line to its terminus, also tanks, ships, and even consumer equipment.

The Texas systems consist of two separate lines not interconnected. One is an 8-in. trunk line extending from the company's Corpus Christi refinery to Austin via Victoria, Cuero, Gonzales, and Luling, with a 6-in. lateral from Luling to San Antonio. Pipeline working storage is provided at Luling for supplying sales requirements at Luling, Austin, and San Antonio as needed, and another sales terminal is located at Victoria.

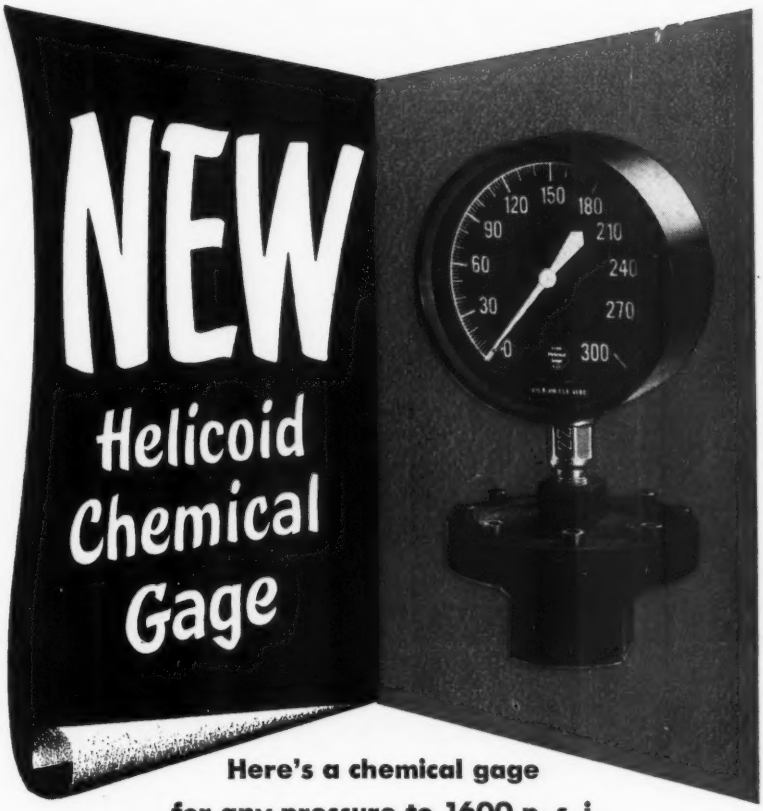
The other system is a 10-in. trunk line from Houston to a point north of Arlington, Tex., between Fort Worth and Dallas with sales terminals located at North Houston, Bryan, and Waco. Only two pump stations were built, one at the Houston refinery and the other at Hearne. Requirements of products at Dallas and Fort Worth are delivered from products pipe line working storage at Arlington through 3-in. lines built in 1941. All of these lines were put into operation in June 1948, and handle the regular run of refined petroleum products as required.

During June another 8-in. products line was completed from Arlington, Tex., to Shawnee, Okla., which interconnects with an existing 8-in. crude line extending north to near Tulsa, Independence, Kansas City, Standish, Fort Madison, Joliet, on to the company's refinery at East Chicago, with another 8-in. line branching east from Standish to St. Louis, and across the Mississippi River to Wood River, Ill. A 6-in. branch line will supply the Kansas City and St. Louis areas. The products line coming into Chicago from the Gulf Coast can deliver into the Chicago area, receive and pump products from the East Chicago refinery south or pump directly east through the Chicago-Toledo line as needed. Reconditioning of the crude line for products service has been completed as far as Kansas City and this line started operations late last month. Reconditioning of the 8-in. line into Wood River is almost completed with similar work, including stations and terminals, pushing ahead on the Chicago line with hope that the entire system will be ready to operate by late 1948.

New A.P.I. Publications

Two new production publications, the A.P.I. R.P. 31 — Recommended Practice for Standard Electrical Log Form, and the A.P.I. Code 32—Code for Testing Cements Used in Wells, are now available, according to the American Petroleum Institute.

Copies of these publications may be obtained from the A.P.I., division of production, 1205 Continental Building, Dallas.



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The diaphragm is "TEFLON" which resists practically all corrosive chemicals. The diaphragm chamber is supplied of any metal most suitable for the service.

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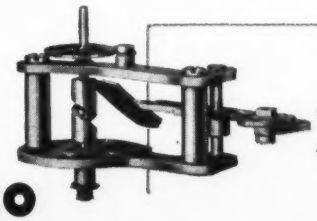

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TRADE MARK

Radio equipment at field office of pipe-line spread

Radio Communication Essential to Pipe-Line-Construction Work

by B. G. Pierce*

NO other heavy-construction industry needs the mobility, speed of movement, coordination, and fast action of pipe-line construction. Even with present-day large-diameter pipe lines, rates in excess of 1 mile per day are now being considered normal progress. The large units of heavy equipment such as bulldozers, ditching machines, backhoes, draglines, sidebooms, etc., moving at this or at faster rates require close coordination, so that each division of the work will contribute to the progress of the entire job.

Immediately following termination of World War II, Federal Communications Commission made available certain frequencies and radio facilities to pipe-line-construction contractors. Taking advantage of this opportunity, The H. C. Price Co., on an experimental basis, completely equipped one spread with radio facilities in 1946. These radio facilities consisted of a central station located in the project office, and radio units in the car or pickup of each superintendent, foreman, utility welder, mechanic, and material man. The central station is operated on an FCC assigned frequency of 30.82 megacycles with power output of 50 watts. Automotive equipment carrying mobile units with power output of 30 watts were equipped with spring-base rear-mounted antennas. All transmitters and receivers were crystal controlled to maintain one-frequency operation, and to assure maximum range of communication. Radio towers most commonly used with fixed stations, varying from 100 to 300 ft. in height, have not been used due to the frequent changes in the station locations. The system used is classed as "portable," since it may be moved from location to location anywhere in continental United States on notification to FCC.

After these radio installations were completed and all transmitters and receivers were in operation, a careful survey was made with a view towards ascertaining the benefits of such facilities from a practical construction standpoint. Within a very short period, it was determined that the value of these facilities justified their cost.

There was rapid increase in the over-all progress of this first pipe-line job on which this experiment was conducted which resulted in a reduction of construction costs because of better coordination.

Savings Effected

A few examples of field application of radio communications may be cited. For instance, when a breakdown occurs in a vital piece of equipment, the foreman can now radio the mechanic to go to the trouble immediately. In turn, the mechanic can radio an order to the warehouse for parts requirements which may be rushed to the location. This fast action may possibly avert shutdown of an entire crew. If parts are not in stock, the construction office may be contacted with immediately so that parts may be ordered from the manufacturer. If it becomes imperative for a utility welder to make a tiein or to do some other utility job, the foreman, by means of radio, may get him on the job immediately. Otherwise it would be necessary for the foreman to drive up and down the right-of-way, sometimes 6 or 8 miles, to locate a utility welder.

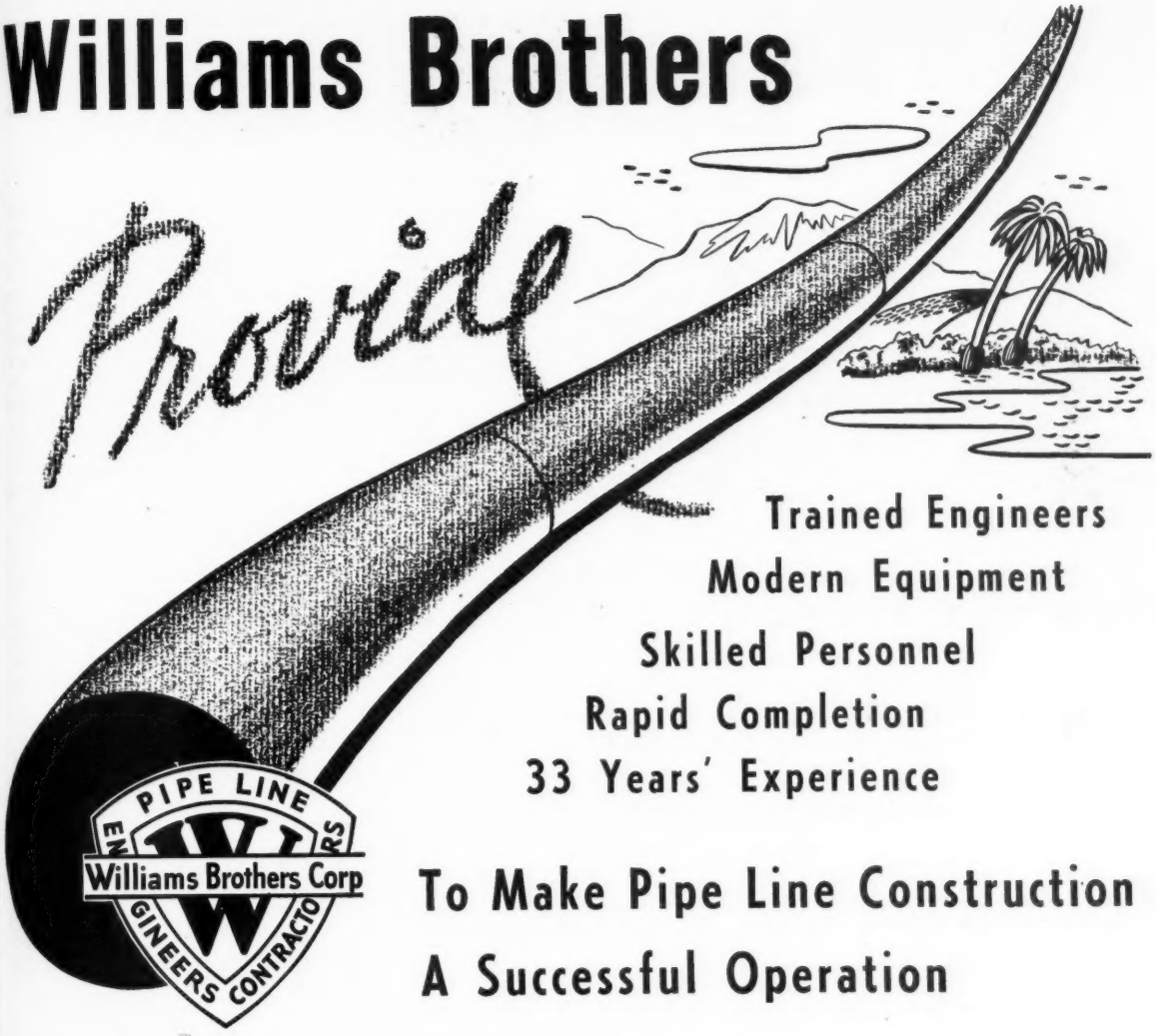
Radio furnishes the spread superintendent with a dependable, speedy, and simple communication system for his needs in communicating with the project office to procure additional employes or to direct the various activities of the spread.

Today all spreads of The H. C. Price Co. are equipped with radio communications facilities which are recognized as essential to this company's operations.

Telephone for radio communication from contractor's pickup

*The H. C. Price Co.

Williams Brothers



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Williams Brothers Corp. is equipped to successfully plan and project, with both speed and economy, pipe line projects anywhere on earth.

The ability of Williams Brothers is revealed in their past record of the successful construction of 35,000 miles of pipe lines on three continents in the past 33 years.

Take advantage of Williams Brothers' staff of expert engineers, skilled workmen, modern equipment and years of successful operation.

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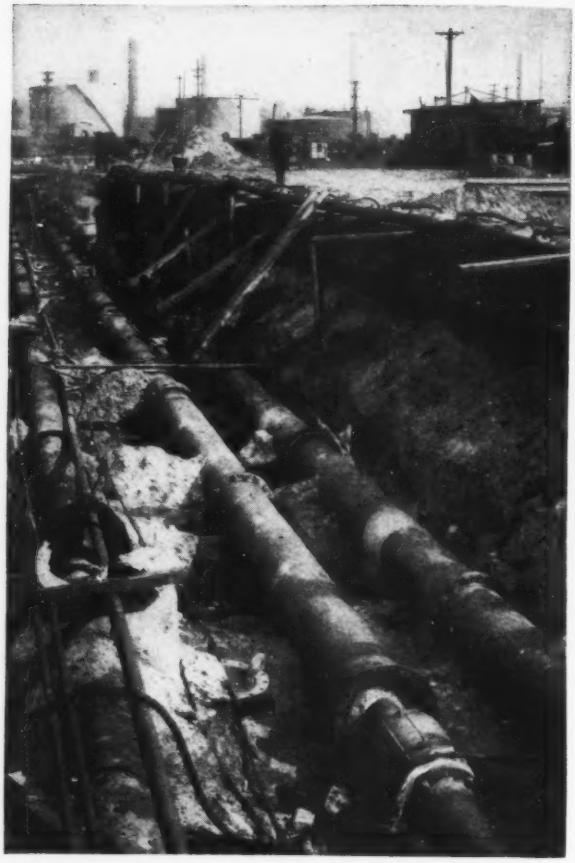

CAST IRON JACKETS FOR REFINERY STEAM LINES

The photo shows 18-inch flanged cast iron pipe being installed to serve as jackets to protect insulation on an 8-inch high-pressure steam line at a refinery. Service rendered to the petroleum industry by cast iron pipe may not always be as spectacular but it is always reliable and economical. No other pipe, at reasonable cost, offers comparable resistance to interior and exterior corrosion. Figured per service-year the direct economy of cast iron pipe is substantial. Available with bell-and-spigot, plain end and flanged, or with standardized mechanical joints. Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago 3. Illinois.

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Then as a clincher . . . try any of these famous, widely known Cities Service products . . . CISCO SOLVENT . . . CISCO PEP . . . CITIES SERVICE MOTOR OILS . . . CITIES SERVICE GASOLENES . . . plus four hundred others. They're all top quality, right on down the line. And every one is paying off in a big way for Cities Service dealers.

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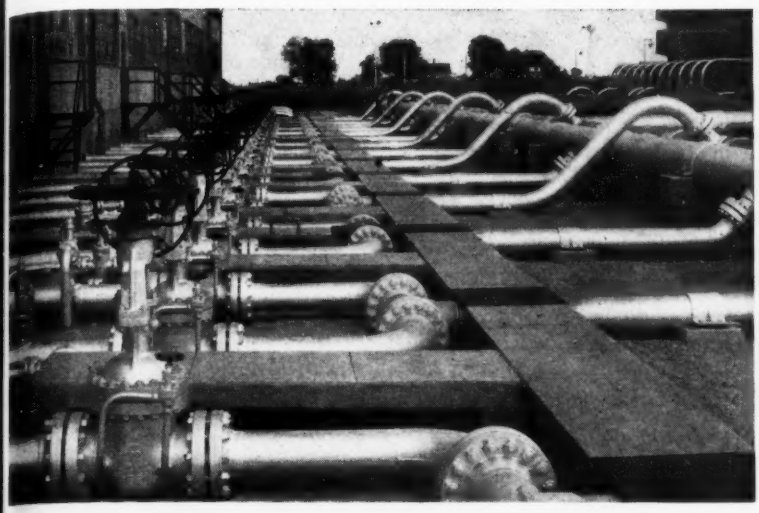
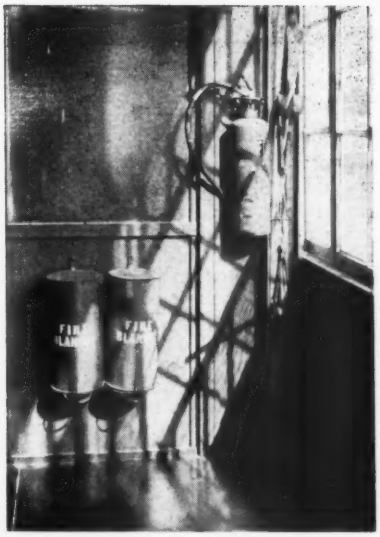
PIPE-LINE SUGGESTIONS



Bypass Connections on Large Valves

BYPASS connections have been installed at all large valves of a major transmission line. The operation of opening the small valve on the bypass line allows gas to pass slowly from the high-pressure to the low-pressure side; thus pressure is equalized in advance of opening the large valve.



Fire Extinguisher at Compressor Station

FIRE extinguisher, fire blanket holders, and stretcher are placed together at a convenient corner near the window of natural-gas pipe-line compressor station where they are readily accessible in an emergency.

Line-Up Clamp for Large Pipe

CLAMPS of a type used in tank building were utilized at Seminole, Okla., during the laying of several miles of 30-in. pipe which was considerably egg-shaped when delivered. Such a device is hinged on one side. The two ends of the clamp on the other side are brought together by a hydraulic jack-and-chain device. These clamps restore roundness and hold the pipe during tack welding. The clamps were convenient for meeting emergency conditions in laying 30-in. pipe for a short distance. For laying large pipe for any considerable distance, an internal line-up clamp is more effective when it can be procured.

Major Pipe-Line Construction Projects

by R. B. Tuttle

REPORTS on activities of the pipe-line industry obtained directly from operating and construction companies by The Oil and Gas Journal indicate some 2½ years may be required to complete the bulk of projects now planned, authorized, or under consideration. The projects reported in this group involve approximately 25,000 miles of various line sizes for installation in the United States only. Natural-gas lines rank first in the group with 19,000 miles. Crude-oil transportation facilities are second at some 5,000 miles and the length of products lines 1,000 miles.

Domestic projects now under construction round out at 6,000 miles of which natural-gas line distances again rank first. Products and crude-oil-line construction nearly totals 2,500 miles, with new natural gas lines totaling 3,500.

Projects completed in the United States to date for all three types of lines, crude oil, natural gas, and products, total 6,500 miles. In this group total lengths of each type of line are nearly equal.

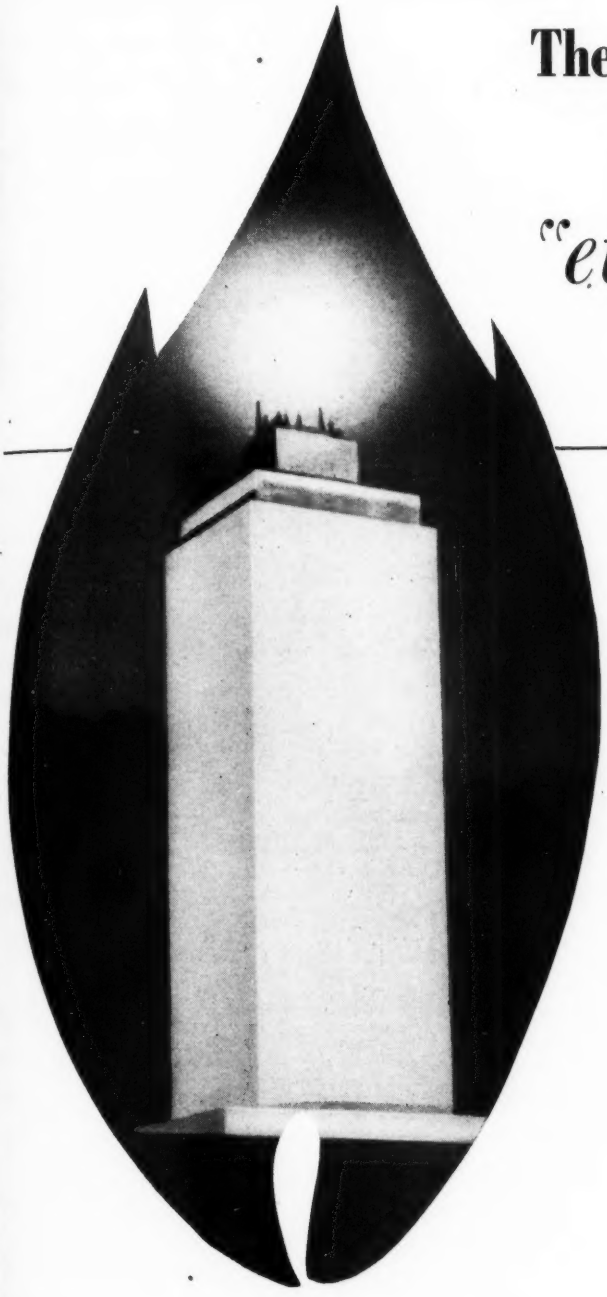
Total foreign projects under construction run upwards of 4,500 miles. Planned foreign projects indicate a rounded figure of 7,500 miles of which crude-oil lines rank first. Natural-gas projects now under way are reported at approximately 1,700 miles and crude-oil lines now being built total upwards of 2,700 miles.

All of the major and some of the smaller domestic and foreign pipe-line projects reported in the Journal's recent survey are listed in the accompanying tables. Lines completed in 1948, those now under construction, and those planned, authorized or under consideration, both foreign and domestic, total approximately 50,000 miles.

TABLE 1—MAJOR DOMESTIC CRUDE-OIL PROJECTS

Company—	Miles	Inch	Status	Contractor and location
Arizona Pipe Line Co.	**600**	**8**	**Planned**	**Permian basin-Phoenix, Ariz.**
Atlantic Pipe Line Co.	400	10	Planned	Crane County to Corpus Christi, Texas.
Buckeye Pipe Line Co.	110	12	Under way	Sheehan Pipe Line Construction Co.—Cygnet, Ohio to Cleveland.
Buckeye Pipe Line Co.	82	22	Authorized	Lima to Toledo, Ohio.
Continental Pipe Line Co.	**16**	**6**	**Completed**	**C. L. Rogers Construction Co.—Wichita Falls refinery to Ringgold-Joy Junction, Tex.**
Cooperative Refinery Association	20	8	Under way	Jayhawk Construction Co.—Cowley County, Kansas.
Cooperative Refinery Association	48	6	Authorized	Cowley County, Kansas.
Derby Oil Co.	**30**	**4**	**Under way**	**Company crews—Wellington to Chase, Kans.**
Frontier Refining Co.	**65**	**..**	**Planned**	**Mush Creek and Ant Hill, Colo., to Rocky Mountain Pipe Line Co. system.**
Gulf Refining Co.	102	8-12	Completed	Smith Contracting Co., Latex Construction Co., Carl Dunn—Midland-Lufkin, Tex., loops.
Humble Pipe Line Co.	**24**	**12**	**Completed**	**Sheppard-Geiger Construction Co.—Lytle-Ingleside, Tex.**
Humble Pipe Line Co.	9	8	Under way	Stewart Lease Service—Refugio-Ingleside, Tex.
Humble Pipe Line Co.	7	2-4	Under way	Royce L. Boyd Co.—Gathering lines, Shackelford, Tex.
Humble Pipe Line Co.	7	3-4-6	Authorized	Sanders pool to Albany, Tex.
Humble Pipe Line Co.	11	8	Completed	Morrison Bros. Const. Co.—Dollarhide field, Texas.
Humble Pipe Line Co.	12	6	Completed	Royce L. Boyd Co.—Woodson-Albany, Tex.
Humble Pipe Line Co.	9	8	Completed	Massey Pipe Line Const. Co.—Pettus-Refugio, Tex.
Humble Pipe Line Co.	7	8	Completed	Latex Construction Co.—Hastings-Webster, Tex.
Humble Pipe Line Co.	13	6-8	Completed	J. J. Willis Const. Co.; Royce L. Boyd Co.—Ector-Judkins and Albany-Putnam, Tex.
Interstate Oil Pipe Line Co.	**53**	**12**	**Completed**	**Midwestern Construction, Inc.—Oklahoma City-Maysville, Antioch, Okla.**
Interstate Oil Pipe Line Co.	**9**	**4**	**Completed**	**Campbell Welding Works—Sugar Creek, Ala., to Hico-Knowles field, Louisiana.**
Lion Oil Co.	20	2-3-4-6	Under way	Murry Const. Co.; Bennie Ferguson Const. Co.—Gathering lines, Arkansas.
Magnolia Pipe Line Co.	**648**	**20**	**Completed**	**Oklahoma Contr. Co., H. C. Price & Co., Eastern Const. Co., O. C. Whitaker Co.—Corsicana, Tex.-Patoka, Ill.**
Magnolia Pipe Line Co.	210	20	Completed	Oklahoma Contracting Co., Inc.—Conway, Ark., north through Missouri to Mississippi River.
Mid-Continent Pipe Line Co.	**31**	**4-6**	**Completed**	**C. P. Carter, A. C. Holder—Canadian River area and Yale-Drumright, Okla.**
Ohio Oil Co.	12	4	Under way	Carbon County, Wyoming.
Ohio Oil Co.	6	12	Completed	Washakie-Hot Springs counties, Wyoming.
Ohio Oil Co.	6	10	Completed	Crawford County, Illinois.
Pan American Pipe Line Co.	16	6-8	Authorized	Loop, Quitman-Kilgore, Tex.
Pan American Pipe Line Co.	42	4-6	Completed	Altgelt Const. Co.—Gathering system, Bee-Karnes and Wood counties, Texas.
Petroleum Products Refining & Producing Co.	31	4	Under way	Company crews—Hospah field to Prewitt, N. M.
Phillips Pipe Line Co.	**289**	**12**	**Authorized**	**Odessa to Borger, Tex., to be completed April 1949.**
Portland Pipe Line Co.	**236**	**20**	**Planned**	**Portland, Me.-Montreal, Que., Can.**
Rocky Mountain Pipe Line Co. (Continental)	118	10	Completed	**Osage Const. Co., R. H. Fulton Co., Goldenstern & Stolper, Inc.—Denver, Colo., to Cheyenne, Wyc.**
Rocky Mountain Pipe Line Co.	30	8	Completed	Goldenstern & Stolper, Inc.—Chugwater, Wyo., area.
Salt Lake Pipe Line Co.	**181**	**8-10**	**Under way**	**Pacific Pipe Line & Engineers, Ltd.—Rangely, Colo., to Salt Lake City, Utah.**
Shell and other companies	**1,000**	**20**	**Planned**	**Wink, Tex.-Wilmington, Calif., 1950-1952.**
Shell Pipe Line Corp.	20	10	Under way	Smith Contracting Corp.—Wheeler-Wink, Tex.
Shell Pipe Line Corp.*	435	22	Authorized	Cushing, Okla.-Wood River, Ill.
Shell Pipe Line Corp.	73	12-14	Authorized	Wasson, Tex.-Jal, N. M., via Hobbs, N. M.
Skelly Oil Co.	8	6	Completed	Bishop and Lock—Stephens County, Oklahoma.
Socony-Vacuum Oil Co., Inc. (White Eagle Division)	**122**	**8**	**Under consideration**	**Big Horn basin to Casper, Wyo.**
Socony-Vacuum Oil Co., Inc. (White Eagle Division)	42	6	Completed	Knupp Const. Co.—Graham County, Kansas, to Sheridan County, Kansas.
Southern Pipe Line Co.	8	2-4	Completed	Brown & Root, Inc., Bishop and Odem areas, Texas.

To All Delegates and Visitors To The A.G.A. Convention and The G.A.M.A. Exhibition



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Virginia Gas Transmission Corporation
Big Marsh Oil Company
The Ohio Fuel Gas Company
Central Kentucky Natural Gas Company
Binghamton Gas Works
Cumberland and Allegheny Gas Company
Eastern Pipe Line Company
Gettysburg Gas Corporation
Virginian Gasoline and Oil Company
United Fuel Gas Company
Home Gas Company
The Keystone Gas Company, Inc.
The Preston Oil Company
Natural Gas Company of West Virginia
Union Gasoline and Oil Corporation

TABLE 1—MAJOR DOMESTIC CRUDE-OIL PROJECTS (Continued)

Company—	Miles	Inch	Status	Contractor and location
Stanolind Pipe Line Co.	263	20-22	Completed	O. C. Whitaker Co., Associated Cont. & Engrs., J. R. Horrigan Const. Co.—La Plata, Mo.-Manhattan, Ill.-Drumright, Okla.-Whiting, Ind.
Stanolind Pipe Line Co.	51	8	Completed	R. H. Fulton & Co.—Post pool-Petersburg, Tex.
Stanolind Pipe Line Co.	84	16	Completed	R. H. Fulton & Co., O. C. Whitaker Co.—Slaughter, Tex.-Drumright, Okla. (175-mile, 16-in. looping).
Stanolind Pipe Line Co.	81	10-12	Under way	Smith Contracting Corp.—Wheeler-Wasson, Tex., extension.
Stanolind Pipe Line Co.	12	20	Completed	Midwestern Constructors—Hominy-Nelagoney, Okla. loops.
Stanolind Pipe Line Co.	55	8	Completed	C. L. Rodgers Construction Co.—Wamsutter to Ferris Dome, Wyo.
Stanolind Pipe Line Co.	23	12	Completed	Pacific Pipe Line & Engineers, Ltd.—Lost Cabin to Arminto Junction, Wyoming.
Stanolind Pipe Line Co.	35	12-16	Completed	R. H. Fulton & Co.—Welch, Wyo.-Freeman, Mo. loops.
Stanolind Pipe Line Co.	190	16	Under way	R. H. Fulton & Co., O. C. Whitaker Co., Smith Contr. Co., Latex Const. Co.—Slaughter, Tex., to Drumright, Okla., loops.
Stanolind Pipe Line Co.	73	8-10	Under way	O. C. Whitaker Co.—Steamboat-Lost Cabin, Wyo.
Stanolind Pipe Line Co.	239	10-16	Under way	R. H. Fulton Co., R. B. Potashnick, C. S. Foreman & Co.—Welch, Wyo.-Freeman, Mo., loops.
Stanolind Pipe Line Co.	43	16	Authorized	Welch, Wyo.-Freeman, Mo., loops.
Stanolind Pipe Line Co.	54	12	Authorized	La Plata, Mo.-Wood River, Ill., loops.
Stanolind Pipe Line Co.	35	12	Under way	O. C. Whitaker Co.—Arminto-Casper Creek Junctions, Wyoming.
Sun Pipe Line Co.	29	4-6-8	Completed	Altgelt Construction Co.—Starr-Jim Wells counties, Texas.
Sunray Oil Corp.	28	4-8	Completed	Pipe Line Service Co.—Velma-Beckett, Okla.
Texas Pipe Line Co.	60	16	Under way	Latex Construction Co.—West Columbia, Tex.-Houston.
Texas Pipe Line Co.†	90	20	Completed	Morrison Const. Co., Inc.—Jal, N. M.-Midland, Tex.
Texas Pipe Line Co.†	253	22	Completed	Latex Const. Co.—Midland, Tex.-Wichita Falls, Tex.
Texas Pipe Line Co.†	173	24	Under way	Smith Contracting Corp.—Wichita Falls, Tex.-Cushing, Okla.
Texas Pipe Line Co.	87	20	Under way	Latex Const. Co.—Houston, Tex.-Port Arthur, Tex.
Texas Pipe Line Co.	187	12	Authorized	Wichita Falls, Tex.-Corsicana, Tex.
Texas Pipe Line Co.	54	22	Authorized	Wood River-Patoka, Ill.
Texas-Western Oil Lines, Inc.	1,000	20 or 24	Proposed	Midland-Odessa area, Texas, to Los Angeles, Calif.
Toronto Pipe Line Co.	18	2-3-4	Completed	Altgelt Construction Co.; Stewart Construction Co., Williams Weld Co.—Goliad County, Texas.
Union Oil Co. of California	20	8-10	Planned	Miscellaneous crude and products.

*Ozark Pipe Line System of Shell Pipe Line Corp. and Texas Pipe Line Co. Shell Pipe Line Corp. is handling construction. †Jal-Cushing Pipe Line System of Texas Pipe Line Co., Shell Pipe Line Corp., Empire Pipeline Co., Sinclair Refining Co. Texas Pipe Line Co. is handling construction.

TABLE 2—LARGE DOMESTIC PRODUCTS-LINE PROJECTS

Connecticut Pipe Line Co.	40	8	Planned	New Haven-Hartford.
Great Lakes Pipe Line Co.	...	...	Completed	12 booster stations.
National Cooperative Refinery Association	25		Under way	M. E. White Pipeline Const. Co.—Council Bluffs, Iowa-Irvington, Neb.
Phillips Petroleum Co.	37	6	Completed	Borger-McKee, Tex.
Phillips Petroleum Co. and Shamrock Oil & Gas Co.	152	6	Planned	La Junta to Denver, Colo.
Phillips Petroleum Co. and Shamrock Oil & Gas Co.	115	8	Completed	Deaton & Sons, Vaughn & Taylor—Borger, Tex.-Paola, Kans., loops.
Shell Oil Co., Inc.	14	4	Authorized	Wilmington refinery to Los Angeles, Calif.
Shell Oil Co., Inc.	222	8	Under way	Restationing of East Products Pipe Line.
Shell Oil Co., Inc.	250	8	Completed	Restationing program on North Products Pipe Line.
Sinclair Refining Co.	248	6	Completed	O. C. Whitaker Co.—Corpus Christi-San Antonio-Austin, Tex.
Sinclair Refining Co.	264	10	Completed	H. C. Price & Co.—Houston-Fort Worth, Tex.
Sinclair Refining Co.	185	8	Completed	Pacific Pipe Line & Engineers, Ltd.—Fort Worth-Panova Station, Okla.
Sinclair Refining Co.	290	8	Completed	Company crews and outside contractors—Panova, Okla.-Redel, Kans., recondition crude line for products.
Sinclair Refining Co.	270	8	Under way	Company crews and outside contractors—Redel, Kans.-Wood River, Ill., recondition crude line for products.
Sinclair Refining Co.	20	6	Completed	Company crews and outside contractors—Redel, Kans.-Kansas City, recondition for products.
Sinclair Refining Co.	26	8	Under way	John Meehan & Son Construction Co. and Ralph Hopple—Marcus Hook-Philadelphia.
Sinclair Refining Co.	376	8	Under way	Company crews—Carrollton, Mo.-East Chicago, reconditioning for products.
Sinclair Refining Co.	700	8	Planned	Sinclair, Wyo.-Kansas City.
Socony-Vacuum Oil Co., Inc.	127	6	Under way	Associated Contractors & Engineers—Portland-Bangor, Me.
Socony-Vacuum Oil Co., Inc.	155	8	Under way	Midwestern Constructors, Inc.—Binghamton, N. Y. to Malvern, Pa.
Socony-Vacuum Oil Co., Inc.	54	6	Authorized	Binghamton-Malvern branch lines.
Southeastern Pipe Line Co.	...	...	Under consideration	Pump stations at Wawahitchka, Fla., River Junction, Fla., and Newton, Ga.
Stratton Pipe Line Corp.	8	4	Completed	Henry Lemons & Co.—Nueces County, Tex.
Sunray Oil Corp.	96	6	Completed	Pipe Line Service Co.—Allen to Duncan, Okla.
Texas Pipe Line Co.	143	10	Completed	Associated Contr. & Engrs., Inc.—Hearne-Dallas, Tex.
Texas Pipe Line Co.	26	8	Completed	Associated Contr. & Engrs., Inc.—Dallas-Fort Worth, Tex.
Texas Pipe Line Co.	79	8	Completed	Latex Const. Co.—Hearne-Austin, Tex.

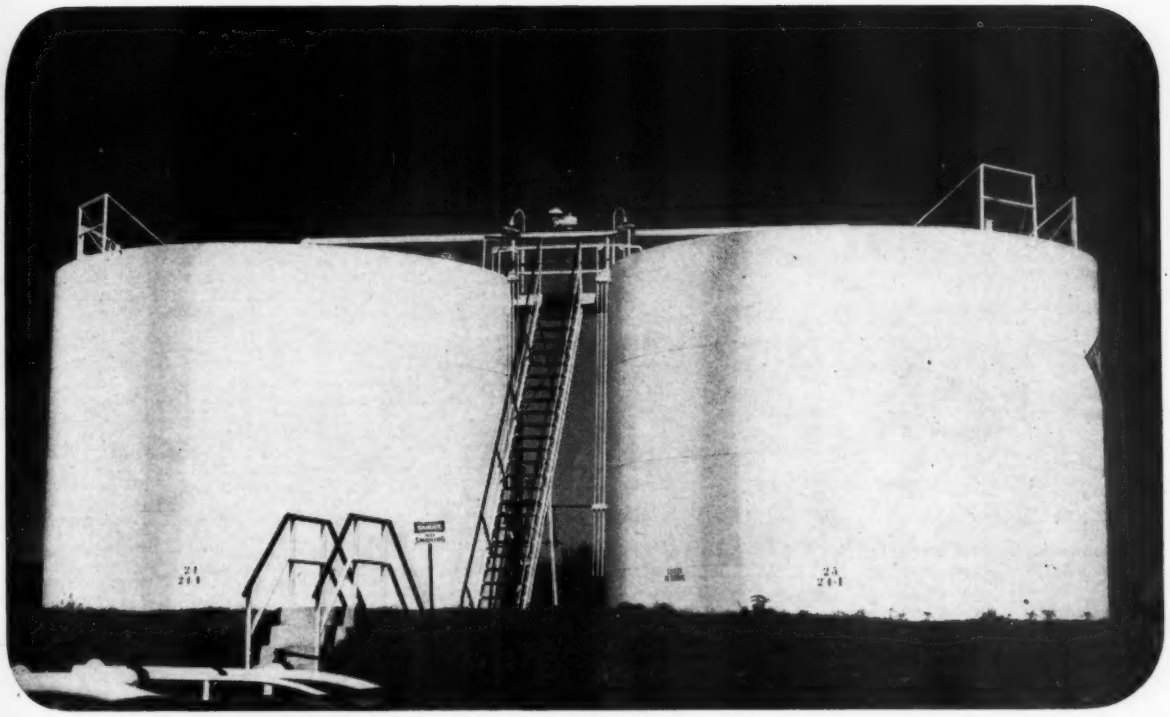

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TABLE 2—LARGE DOMESTIC PRODUCTS-LINE PROJECTS (Continued)

Company—	Miles	Inch	Status	Contractor and location
Texas Pipe Line Co.	28	6	Completed	Latex Const. Co.—Austin-San Marcos, Tex.
Triangle Pipe Line Co.	42	8	Completed	Rosson-Richards Co.—Carthage-Larosen, near Shreveport, La.
Union Oil Co. of California	10	6	Planned	Torrance to Rosecrans.
Wyco Pipe Line Co. (Standard of Indiana-Texas Co. and Socony-Vacuum Oil Co., Inc.	267	8	Completed	Pacific Pipe Line & Eng., Ltd., Allred-Enix Const. Co.—Casper, Wyo., to Denver, Colo.

TABLE 3—PRINCIPAL DOMESTIC NATURAL-GAS PROJECTS

Alabama-Tennessee Natural Gas Co.	75	10	Planned§	From Tenn. Gas Trans. Co. line near Selmer, Tenn., to Tuscombia, Ala.
Alabama-Tennessee Natural Gas Co.	61	6	Planned§	Tuscombia to Huntsville, Ala.
Arkansas Louisiana Gas Co.	27	6	Completed	Columbia, Arkansas, gas treating plant, lines to Haynesville, La., and Salem Church, Arkansas, fields.
Atlantic Gulf Gas Co. (United Gas P. L. Co.)	1,530		Planned¶	Alabama-Florida-Georgia-South Carolina.
Atlantic Seaboard and Virginia Gas Transmission Co.	269	24	Planned	Clendenin, W. Va.-Rockville, Md.
Chicago District Pipeline Co.	12	24	Authorized	Joliet, Ill., to 1 2miles, N.E., 1948.
Chicago District Pipeline Co.	42	24	Authorized	Joliet-Chicago, Ill., 1953.
Cities Service Gas Co.*	184	26	Under way	Ray L. Smith & Sons, Inc.—Ulysses-Hutchinson, Kans.
Cities Service Gas Co.*	55	26	Completed	Midwestern Constructors, Inc.—Ottawa-Olathe, Kans.-Martin City, Mo.
Cities Service Gas Co.	45	20	Completed	Company crew—Liberty, Kans.-Military, Kans.
Cities Service Gas Co.*	405	26	Under way	Ulysses, Kans.-Kansas City, Mo.
Coast Counties Gas & Electric Co.	40	3-4-8	Under consideration	Coast and Valley region, California.
Colorado-Wyoming Gas Co.	100	8	Completed	Pacific Pipeline & Engineers, Ltd.—Cheyenne, Wyo.-Denver.
Commonwealth Natural Gas Corp.	537	20	Planned	West Bend, Ky.-Norfolk, Va.
Consolidated Gas Utilities	8	6-8	Under way	Lawton-Duncan, Oklahoma area.
Consolidated Gas Utilities	41	12	Under consideration	Enid to Blackwell, Okla.
Consolidated Gas Utilities	20	12	Under consideration	Marlow to Cement, Okla.
Dow Chemical Co.	24	12	Completed	Latex Const. Co.—Bay City, Tex., area.
Dow Chemical Co.	15	8-10	Completed	Latex Const. Co.—Citrus Grove and Bay City, Tex., area.
East Ohio Gas Co.	84	20	Under way	Williams Brothers Corp.—Switzerland Township, Belmont County, to Jackson Township, Stark County, Ohio.
Egyptian Natural Gas Co.	80	6-8	Planned‡	Norris City to Salem-Centralia, Ill., areas.
East Tennessee Natural Gas Co.	398	3-16	Planned	Nashville-Chattanooga-Knoxville, Tenn., and lateral lines.
El Paso Natural Gas Co.	189	12-18	Completed	Gathering lines in New Mexico and West Texas.
El Paso Natural Gas Co.	450	30	Planned‡	Eunice, N. M.-Blythe, Calif., looping.
El Paso Natural Gas Co.	248	24	Under way	Eunice, N. M.-Dumas, Tex., extension.
El Paso Natural Gas Co.	83	4-16	Planned	Expansion to serve Tucson and Phoenix, Ariz.
El Paso Natural Gas Co.	96	24	Planned	From 45 miles east of Blythe, Calif., to proposed line to Needles, Calif.
Empire Southern Gas Co.	4	2-4	Under way	Curtis Brothers—Gathering lines, Andrews County, Texas.
Empire Southern Gas Co.	13	2-8	Completed	El Paso Natural Gas Co.—Gathering lines, Andrews County, Texas.
Gulfcoast Northern Gas Co.	1,184	26	Planned	Texas Gulf Coast to Chicago area.
Home Gas Co.	30	12	Under way	Britton Contracting Co.—Hancock to Cochecton, N. Y.
Home Gas Co.	25	10	Under way	Britton Contracting Co.—Horseheads to Dundee, N. Y.
Home Gas Co.	10	4-12	Authorized	Dundee Storage Field Lines, Yates County, New York.
Home Gas Co.	5	14	Completed	Williams Brothers Corp.—Port Jervis to Deer Park, N. Y.
Hope Natural Gas Co.	40	8-14-16	Planned	Pipe Line Const. Co.—Kopperston, Lockney, and Hastings, W. Va.
Hope Natural Gas Co.	26	14	Under way	Pipe Line Construction Co.—West Virginia.
Houston Pipe Line Co.	20	6-12	Under way	Burt Barry—San Jacinto field to Houston.
Iroquois Gas Corp.	13	22	Planned‡	Loops.
Lone Star Gas Co.	69	20	Under way	Henderson-Dallas counties, Texas.
Lone Star Gas Co.	39	10	Under way	Hopkins-Lamar counties, Texas.
Lone Star Gas Co.	28	3-4-6-8	Completed	Hopkins-Leon-Red River counties, Texas.
Manufacturers Light & Heat Co.	118	14	Completed	Williams Brothers Corp.—Coatesville, Pa., to Port Jervis, N. Y.
Manufacturers Light & Heat Co.	29	4-12	Under way	Britton Contracting Co.—Majorsville storage field lines, Pennsylvania.
Manufacturers Light & Heat Co.	23	4-10-12	Authorized	Pittsburgh area and Donegal and Brinker storage lines, Pennsylvania, 1948.
Manufacturers Light & Heat Co.	7	14	Completed	Richland Co. and Britton Contracting Co. lines to Texas Eastern Transmission Co. lines.
Manufacturers Light & Heat Co.	5	6	Authorized	Steubenville-Wintersville, Ohio.
McCarty Oil & Gas Co.	100	12-14-16-20	Under way	Anderson Bros. Corp.—Jackson Pasture-Orange, Tex.
McCarty Oil & Gas Co.	30	6	Completed	Anderson Bros. Corp.—Winnie-Port Neches, Tex.
Michigan-Wisconsin Pipe Line Co.†	450	24	Under way	J. R. Horrigan Const. Co.—Hansford County, Texas, to Marysville, Mo. (initial construction of 1,548-mile project).
Michigan Consolidated Gas Co. and Austin Field Pipe Line Co.†	130	24	Completed	J. R. Horrigan Const. Co.—Austin gas-storage field, Big Rapids-Detroit, Mich.
Michigan-Wisconsin Pipe Line Co.†	1,098	18-22-24	Authorized	Marysville, Mo., to Millbrook, Ill.; Millbrook, Ill., to Big Rapids, Mich.; Millbrook, Ill., to Milwaukee, Wis., and lateral lines in Missouri, Iowa, and Wisconsin.
Mississippi River Fuel Corp.	16	22	Completed	R. B. Potashnick—Popular Bluff, Mo., area.
Mississippi River Fuel Corp.	221		Planned	Loops on Monroe, La.-St. Louis, Mo., line.
Montana-Dakota Utilities Co.	31	8-12	Under way	C. B. Edmonds—Saco Sta. and Baker, Mont., lines.
Montana-Dakota Utilities Co.	30	4	Authorized	Saco and Baker lines, 1948.
Montana-Dakota Utilities Co.	60	3-4-8-12	Authorized	Field lines for 1948 construction.
Mountain Fuel Supply Co.	35	10	Under way	Salt Lake City to Provo, Utah.

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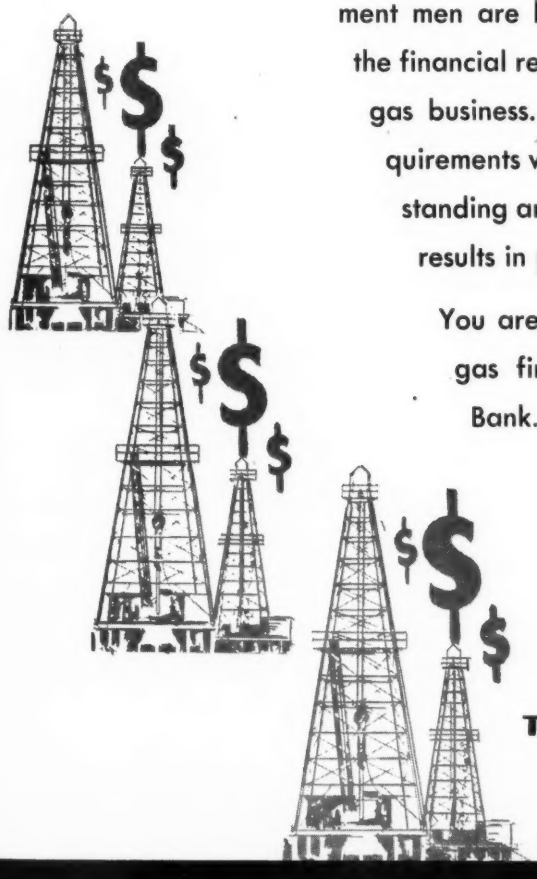

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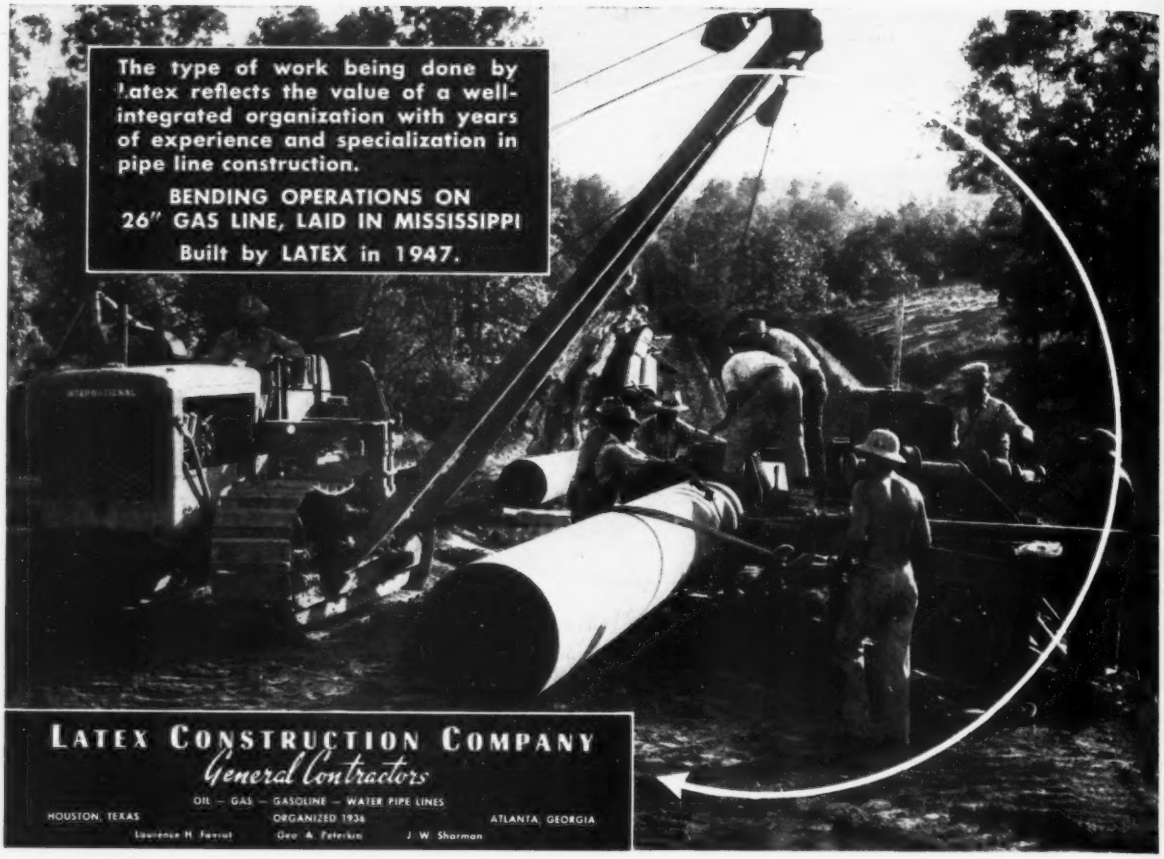
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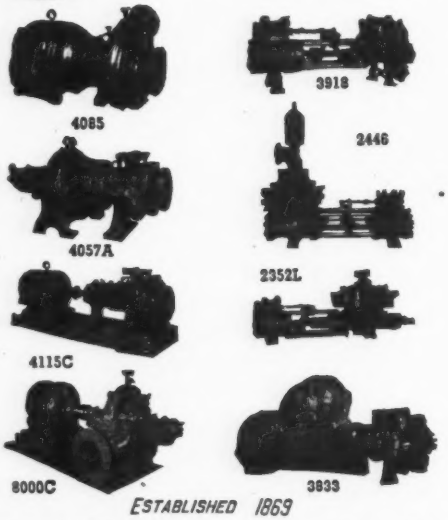

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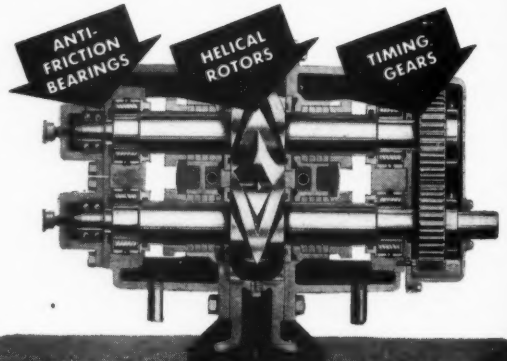

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TABLE 3—PRINCIPAL DOMESTIC NATURAL-GAS PROJECTS (Continued)

Company—	Miles	Inch	Status	Contractor and location
Natural Gas Co. of West Virginia	5	8	Authorized	Near Salem, Ohio.
Natural Gas Pipeline Co. of America	37	26	Completed	R. H. Fulton & Co.—Hooker, Okla., to company's main line, extension to Hugoton field.
Natural Gas Pipeline Co. of America	27	26	Under way	Midwestern Constructors—Main-line looping, Iowa and Illinois.
Natural Gas Pipeline Co. of America	54	24	Under way	H. C. Price & Co.—Main-line looping, Illinois.
New York Natural Gas Corp.	8	16	Under consideration	Allegheny County, Pennsylvania.
Northern Natural Gas Co.	34	10	Planned§	Ames-Marshalltown, Iowa.
Northern Natural Gas Co.	104	4-20	Planned	Hugoton and Panhandle field lines.
Northern Natural Gas Co.	....	..	.....	Compressor installation program for 1948 includes unit totaling 13,400 hp.
Northern Natural Gas Co.	11	24	Under way	C. S. Foreman Co.—Clifton, Kans., area.
Northern Natural Gas Co.	17	6	Under way	Brodie Const. Co.—Sublette-Dodge City, Kans.
Northern Natural Gas Co.	12	16	Under way	R. H. Fulton & Co.—Gathering lines, Sublette, Kans., area.
Northern Natural Gas Co.	40	4-6-8	Under way	Gathering lines, Hugoton field, Kansas, area.
Northern Natural Gas Co.	14	20	Completed	R. H. Fulton & Co.—Gathering lines, Sublette, Kans., area.
Northern Natural Gas Co.	28	24	Planned§	Loops—1949.
Northern Natural Gas Co.	17	20	Planned§	Loops—1949.
Northwest Natural Gas Co.	750		Planned§	Washington, Oregon, and Idaho.
Ohio Fuel Gas Co.	88	20	Under way	Midwestern Constructors, Inc.; Anderson Bros. Corp.—Crawford-Lick stations, Ohio; Lick-South Point stations, Ohio.
Ohio Fuel Gas Co.	48	20	Under way	Mahoney Contracting Co.—Mount Gilead to Treat station; Pavonia station to Washington, Ohio.
Ohio Fuel Gas Co.	8	18	Under way	Anderson Bros. Corp.—Centerville, Ohio, to Station 16, Texas Eastern.
Ohio Fuel Gas Co.	65	10-12	Completed	H. L. Gentry Construction Co.—Lima-Mount Gilead via Marion, Ohio.
Ohio Fuel Gas Co.	64	3-16	Completed	Mahoney Construction Co.—Storage—Ohio.
Ohio Fuel Gas Co.	21	10-12	Completed	Midwestern Constructors, Inc.—Storage and laterals—Ohio.
Oklahoma Natural Gas Co.	66	16	Under way	Trojan Construction Co.—Holdenville to Maysville, Okla.
Oklahoma Natural Gas Co.	30	12	Under way	Trojan Construction Co.—Maysville to Velma, Okla.
Oklahoma Natural Gas Co.	34	12	Under way	Trojan Construction Co.—Maysville to Ninnekah, Okla.
Oklahoma Natural Gas Co.	8	18	.....	Trojan Construction Co.—Bald Hill, Okla., area.
Pacific Gas & Electric Co.	510	30 or 34	Under consideration	Topoc, Ariz., to Milpitas, Calif.
Pacific Gas & Electric Co.	47	8	Authorized	Salinas to Kilig City, Calif.
Pan American Gas Co.	17	16	Completed	Latex Const. Co.—Chocolate Bayou to Texas City.
Panhandle Eastern Pipe Line Co.	200	26	Planned§	Loops to be laid in 1948.
Panhandle Eastern Pipe Line Co.	169	26	Planned§	Loops to be laid in 1949
Panhandle Eastern Pipe Line Co.	356	26	Planned§	Loops to be laid in 1950 and later.
Peoples Natural Gas Co.	5	16	Completed	Williams Brothers Corp.—Gamble-Hayden storage field and Greensburg to Latrobe, Pa.
Peoples Natural Gas Co.	10	12	Completed	Pipeline Construction & Drilling Co.—Dice Sta. to Wilkinsburg, Pa.
Peoples Natural Gas Co.	12	12	Under way	Williams Bros. Corp.—New Kensington to Glenshaw, Pa.
Phillips Petroleum Co.	15	8-10-24	Under way	Vaughn and Taylor Const. Co., Inc.—Gathering system, Goldsmith, Tex.
Phillips Petroleum Co.	96	8-10-14-16-24	Under way	Vaughn and Taylor Const. Co., Inc.—Gathering system, Hansford and Sherman counties, Texas.
Piedmont Natural Gas Corp.	900	20	Planned	Upper Gulf Coast area to Danville, Va.
Potomac Gas Co.	18	16	Planned¶	Dranesville to Arlington, Va.
Rocky Mountain Gas Co.	36	8	Under way	Pipe Line Welding Co.—Medicine Bow to Rawlins, Wyo.
San Juan Pipe Line Co. (El Paso Natural affiliate)	451	26	Planned¶	San Juan Basin, N. M., to Needles, Calif., area.
Skelly Oil Co.	25	4-20	Completed	Bishop & Lock Const. Co.—Velma field, Oklahoma.
Southern California Gas Co.	12	30	Under way	Alex Robertson Co.—Riviera to Pasadena, Calif.
Southern California Gas Co.	102	30	Planned¶	Loops and extension, Santa Fe Springs area.
Southern California Gas Co.	43	6-8-10	Completed	Trico-Delano-Tipton-Porterville, Calif.
Southern Natural Gas Co.	138	20-22	Planned	Chattanooga, Tenn.-Lexington, Miss.
Southern Natural Gas Co.	375	24	Planned¶	Gwinville, Miss.-Atlanta, Ga.
Southern Natural Gas Co.	225	16	Planned¶	Colfax, Ga., extension.
Southern Natural Gas Co.	61	24	Under way	Latex Const. Co.—Eastern Alabama loop.
Southern Natural Gas Co.	40	8	Completed	Latex Construction Co. of Ga., Gwinville to Brookhaven, Miss.
Southern Pipe Line Co.	6	6	Under way	D. D. Pelty—King field to Agua Dulce field, Texas.
Southern Pipe Line Co.	19	4	Under consideration	Saxet to Edroy field, Texas.
Southern Union Gas Co.	92	10-12-14	Authorized	Loops.
Southern Union Gas Co.	38	12	Completed	Farmington to Albuquerque, N. M.
Stanolind Oil & Gas Co.	320	2-30	Under way	Deaton & Sons—Slaughter pool, Texas.
Tennessee Gas Transmission Co.	790	20-26	Planned¶	Burnaugh, Ky.-Boston, including 395-mile line to Buffalo, N. Y.
Tennessee Gas Transmission Co.	992	30	Planned	The first 150 miles of loops to be laid at Monroe, La.; Greenville, Miss.; Midland and Portland, Tenn.
Tennessee Gas Transmission Co.	210	30-31	Under way	H. C. Price Co. and Bechtel Corp.—El Campo, Tex., to Natchitoches, La. (Pipe from Trans-Arabian consignment).
Tennessee Gas Transmission Co.	87	24	Under way	Oklahoma Contracting Co., Inc.—Ky.-W. Va. State line to Cornwell, W. Va.
Tennessee Gas Transmission Co.	45	26	Under way	H. C. Price Co.—Arkansas and Mississippi.
Tennessee Gas Transmission Co.	57	26	Completed	Company crews—Louisiana.
Tennessee Gas Transmission Co.	152	30-31	Under way	Texas.
Tennessee Gas Transmission Co.	55	30-31	Under way	Louisiana.
Tennessee Gas Transmission Co.	80	24	Under way	Anderson Bros.—Kentucky.
Tennessee Gas Transmission Co.	47	30	Authorized	Louisiana.

TABLE 3—PRINCIPAL DOMESTIC NATURAL-GAS PROJECTS (Continued)

Company—	Miles	Inch	Status	Contractor and location
Tennessee Gas Transmission Co.	58	30	Authorized	Mississippi.
Tennessee Gas Transmission Co.	45	30	Authorized	Tennessee.
Tennessee Gas Transmission Co.	112	26	Completed	Latex Const. Co.—Mississippi and Tennessee.
Tennessee Gas Transmission Co.	65	16	Planned	Ohio-Pittsburgh spur.
Tennessee Gas Transmission Co.	46	26	Completed	J. R. Horrigan Const. Co.—Louisiana.
Tennessee Gas Transmission Co.	28	26	Under way	Company crews—Mississippi-Tennessee.
Tennessee Gas Transmission Co.	129	26	Completed	Anderson Bros. Corp.—Kentucky.
Tennessee Gas Transmission Co.	100	26	Under way	Morrison Bros.—Tennessee.
Tennessee Gas Transmission Co.	99	16	Completed	Agua Dulce-San Salvador, Tex.
Tennessee Gas Transmission Co.	83	20	Completed	Latex Const. Co.—Carthage, Tex., spur.
Tennessee Gas Transmission Co.	15	6	Under way	Sheppard-Geiger—Kentucky.
Texas Eastern Transmission Co.	18	8	Authorized	Silsbee and Hastings, Tex., areas.
Texas Eastern Transmission Co.	7	10-12	Authorized	Lincoln Parish, Louisiana.
Texas Eastern Transmission Co.	27	6-8-12	Under way	Brown & Root, Inc.—Laterals in Cheltenham, West Conshohocken and Chester, Pa., areas.
Texas Eastern Transmission Corp.	1,400	26	Planned	Texas-Pittsburgh, Pa., loops.
Texas Gas Transmission Corp.‡	840	20-26	Planned	East Texas-Middletown, Ohio.
Texas Gas Transmission Corp.	63	26	Under way	N. A. Saigh Co.—Lula, Miss., to Memphis.
Transcontinental Pipe Line Co.	1,839	26	Planned§	Rio Grande Valley, Tex.-New York.
Trunkline Gas Supply Co.	885	30	Planned	Wharton, Tex.-Keokuk, Iowa.
United Fuel Gas Co.	32	20	Authorized	Roane, Calhoun and Wetzel counties, West Virginia.
United Fuel Gas Co.	268	26	Under consideration	Clendenin, W. Va.-Rockville, Md.
United Fuel Gas Co.	32	24	Completed	Williams Bros. Corp.—Foster to Brent, Ky.
United Fuel Gas Co.	10	20	Completed	Williams Bros. Corp.—Kenova, W. Va., to Burlington, Ohio.
United Gas Pipe Line Co.	14	7-8	Under way	Brown & Root, Inc.—West Lake Verret field to Oaklawn, La.
United Gas Pipe Line Co.	8	8-10	Under way	Wood Engineering & Const. Co.—Panola County, Texas. Connection from Lone Star gasoline plant to United company's Carthage-Longview line.
United Gas Pipe Line Co.	15	6	Authorized	Mineola to Lindale, Tex.
United Gas Pipe Line Co.	33	20	Completed	Carthage-Longview, Tex.
United Gas Pipe Line Co.	93	18	Planned	Baxterville, Miss.-Mobile, Ala.
United Gas Pipe Line Co.	41	10-12	Completed	Barataria, La.-New Orleans.
United Gas Pipe Line Co.	18	6-12	Completed	Associated Contractors & Engineers, Inc.—Soso, Miss., field to Jackson-Mobile 16-in. line.
United Natural Gas Co.	22	22	Authorized	Replacing 12-in. line Elk County, Pennsylvania.
United Natural Gas Co.	29	12	Authorized	Laterals, Elk County, Pennsylvania.
Warren Petroleum Corp.	60	2-30	Completed	Holland Construction Co.—Antioch-Maysville, Okla., system.
West Texas Gas Co.	6	7	Under way	Z. J. Graham—Littlefield-Levelland, Tex.
West Texas Gas Co.	4	6	Completed	Z. J. Graham—Littlefield-Levelland, Tex.
West Texas Gas Co.	25	7-8	Authorized	Littlefield, Brownfield-Amhurst, Tex.

*Ray L. Smith & Sons, Inc., and Midwestern Constructors, Inc., are laying two sections in 1948 for Cities Service Gas Co.'s 405-mile, 26-in., Ulysses, Kans.-Kansas City, Mo., line. The remainder will be laid later. †The 450 miles of 24-in. being laid by J. R. Horrigan Construction Co. from Texas is the beginning of Michigan-Wisconsin Pipe Line Co.'s 1,548-mile project scheduled for completion July 1, 1950. The Austin field, Michigan, 130-mile, 24-in. line has been laid by Horrigan to serve the eastern end of the project. ‡114 miles 20-in. and 726 miles 26-in. §FPC authorization. ¶FPC authorization requested.

TABLE 4—MAJOR FOREIGN CRUDE-OIL PROJECTS
1948-1955 (announced)

Anglo-Iranian Oil Co., Ltd.	56	20-22	Planned	Agha Jari-Mashur, Iran.
Creole Petroleum Co.	155	24-26	Under way	Williams Brothers Co.—Ule Tank Farm, La Salina-Amuay Bay, Paraguana, Venezuela.
Corporacion de Fomento de Chile	45	8	Planned	Manantiales (Spring Hill), Tierra del Fuego, Chile.
Imperial Oil, Ltd.	500	16	Planned	Leduc, Alta.-Regina, Sask.-Moose Jaw, Sask., Canada.
Imperial Oil, Ltd.	350	..	Planned	Regina, Sask.-Winnipeg, Man., Canada.
Iraq Petroleum Co., Ltd.	1,080	16	Under way	Company crews—Kirkuk, Iraq-Haifa, Palestine, and Tripoli, Lebanon.
Iraq Petroleum Co., Ltd.	556	30-32	Planned	Iraq-Levantine port.
Kuwait Oil Co. Gulf and Anglo-Iranian	1,325	12-22-30	Planned	Kuwait, Arabia, gathering lines and trunk line to Levantine port.
Middle East Pipe Line Co.	800	34-36	Planned	Iran-Levantine port.
Santos Jundiai Railroad	30	18	Planned	Santos-Sao Paulo, Brazil.
S.A. Petrolera Las Mercedes (Texas Co. and Caracas Petroleum Co.)	157	16	Completed	Williams Brothers Co.—Las Mercedes field-Pamatacual, Venezuela.
Trans-Arabian Pipe Line Co.	1,070	30-31	Under way	Abqaiq-Saudi Arabia-Sidon, Lebanon.
Yacimientos Petroliferos Fiscales de Argentina	400	..	Planned	Plaza Huincal-Bahia Blanca, Argentina.
Yacimientos Petroliferos Fiscales Bolivianos	255	6	Under way	Williams Brothers Co.—Camiri-Cochabamba-Sucre, Bolivia.

TABLE 5—LARGE FOREIGN PRODUCTS-LINE PROJECTS

Cie. des Pipe Lines Petroliers Francais	150	10	Planned	Le Havre-Paris, France.
Colombian Government	342	..	Planned	Puerto Berrio-La Dorada, 92 miles; La Dorada-Bogota, 110 miles; La Dorada-Cartago, 140 miles.
Creole Petroleum Corp.	10	8	Under way	Catia de la Mar to Nueva Caracas, Venezuela.
Ministry of Petroleum of Colombia and Antioqua R.R.	107	..	Planned	Puerto Berrio-Medellin, Colombia.
Santos Jundiai Railroad	40	10	Planned	Santos-Sao Paulo-Campinas, Brazil.
Svenska Enterprenad Aktiebolget	220	..	Planned	Uddevalla-Vasteras, Sweden.

TABLE 6—PRINCIPAL FOREIGN NATURAL-GAS PROJECTS

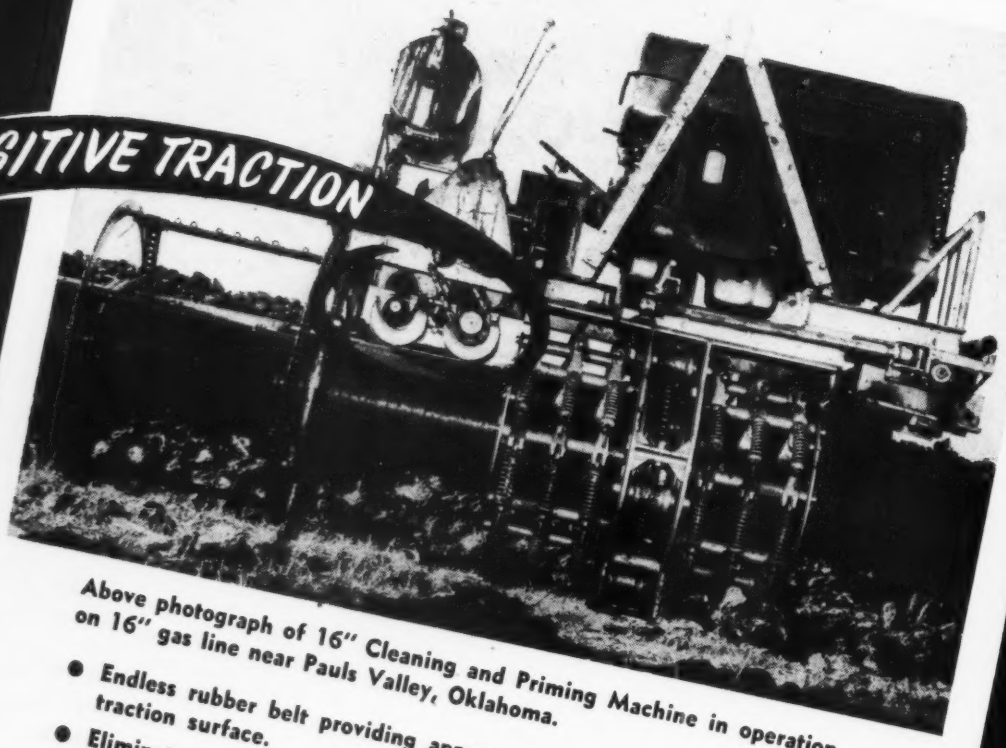
Canadian Western Natural Gas Co., Ltd.	11	16	Completed	Loops Calgary area.
Canadian Western Natural Gas Co., Ltd.	8	5-10	Authorized	Calgary area.
Northwest Natural Gas Co.	600	24	Planned	Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.
Petroleos Mexicanos	150	20	Under way	Williams Brothers Corp.—Posa Rica-Mexico City, Mexico.
Petroleos Mexicanos, Mexican Gas Co. and Industrial Gas Co.	600	..	Planned	Reynosa, Tamaulipas-Mexico City.
Direccion General del Gas del Estado	1,100	10	Under way	Tecnica and government crews—Comodoro-Rivadavia-Buenos Aires, Argentina.
U.S.S.R.	360	..	Under way	Dashiva (in Carpathians)-Kiev, Ukraine.
Western Pipe Line Co.	850	..	Planned	Calgary-Saskatoon, Alta.-Winnipeg, Man.

J. R. HORRIGAN
CONSTRUCTION CO.
Pipe Line Contractors
Commerce Bldg.
HOUSTON, TEXAS
Capitol 9022

PERRAULT *Brothers*

. . . TRACTION BELT DRIVES FOR LINE TRAVELING, CLEANING AND PRIMING MACHINES

POSITIVE TRACTION



Above photograph of 16" Cleaning and Priming Machine in operation on 16" gas line near Pauls Valley, Oklahoma.

- Endless rubber belt providing approximately 100 square inches of traction surface.
- Eliminates damage to pipe surface caused by sharp metal crawler wheels.
- Rubber traction crawler assemblies optional on new machines and available for installation on our machines now in use.

TELEPHONE 5-1104 • 1130 NORTH BOSTON

. . . TRACTION BELT DRIVES FOR LINE TRAVELING, COATING AND WRAPPING MACHINES

Above photograph of 20" Coating and Wrapping Machine in operation on 20" gas line near Lancaster, Ohio.

- Endless rubber belt providing approximately 75 square inches of traction surface.
- Eliminates "burrs" caused by sharp metal crawler wheels, which usually cause holidays in the coating.
- Positive braking action, uphill or downhill, assuring perfect application of coating and wrapping materials.
- Machines equipped with Traction Belt Drive available at no increase in rental rates.
- Positively no damage to primer coat.

PERRAULT *Brothers* INC.

TULSA 6, OKLAHOMA

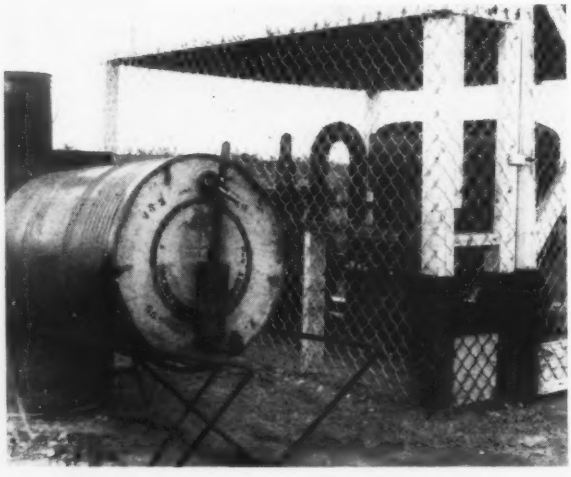
PIPE-LINE SUGGESTIONS

Crude-Oil Sampling Installation

SAMPLES are taken at pipe-line gathering-system connections in New Mexico by a device comprising a riser of the same diameter as the gathering-line pipe, with a small sampling line equipped with valve connected to the top of the riser. Connections are at a convenient position for the gager to obtain crude-oil samples from a position on the ground close to producer's tanks.

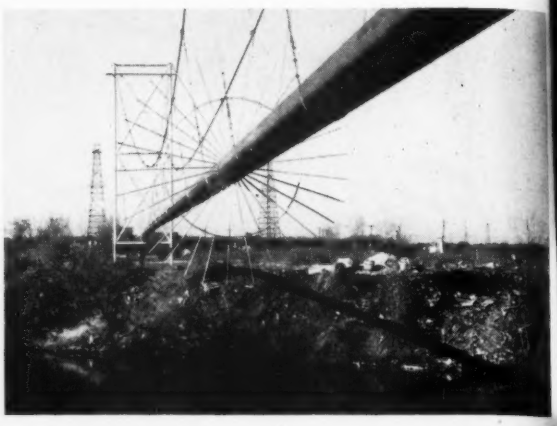
Safeguards at Gathering Unit

TO insure that unauthorized persons do not take lubricating oil from a drum at a pipe-line gathering station in the West Ranch area of Texas, a sleeve has been made of salvaged pipe that fits down over the valve. Above the sleeve a bar extends through a slotted plate on a plug. The position of a padlock in a perforation in this extension bar prevents the sleeve from being lifted sufficiently to allow manipulation of the valve.



Radial Fence on Line Bridging Stream

IN the Oklahoma City field it has been necessary to stop trespassers from using a pipe line suspended over a stream as a short cut. To do this, a circular fence



was placed in the middle of the crossing over the water. Since this fence has been fabricated with rods radiating in all directions from the pipe, it prevents crawling over, under, or around.

Sighting Device on Ditching Machine

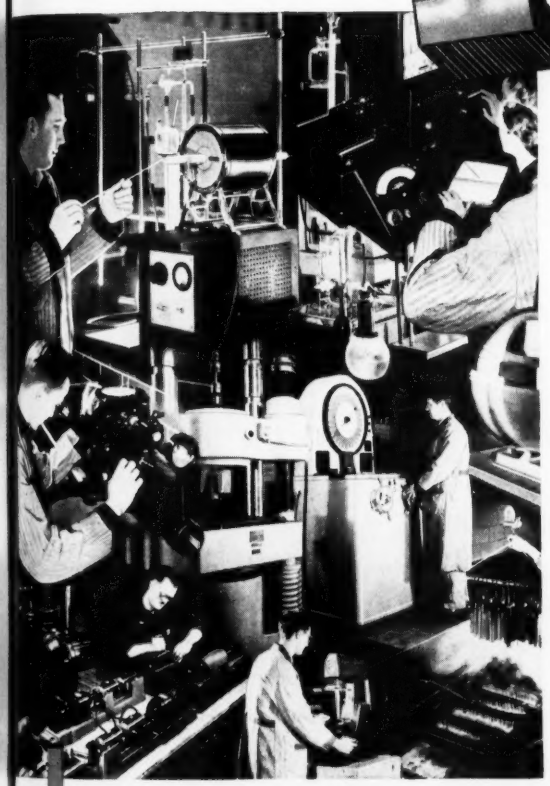
A SIGHTING rod is used by a ditching machine operator. This is held by a counterweight in the form of a 4-in. nipple, swedged at the bottom and filled with lead. The rod swings freely in the socket in which it is held at the end of an arm swung to the side of the ditcher.

HERE IS PROOF

OF LADISH *Controlled Quality*

You have scientific proof of metal soundness in seamless welding fittings when you specify Ladish.

Certified laboratory reports . . . available on request by referring to the Ladish heat code symbol of Controlled Quality marked on every fitting . . . provide complete test data on chemical composition and physical properties of the steel heat from which any Ladish fitting was forged. Here is actual proof of reliability which assures extra years of trouble-free piping service when you install Ladish Seamless Welding Fittings.



A COMPLETE LINE PRODUCED UNDER ONE ROOF
. . . ONE RESPONSIBILITY

LADISH CO.

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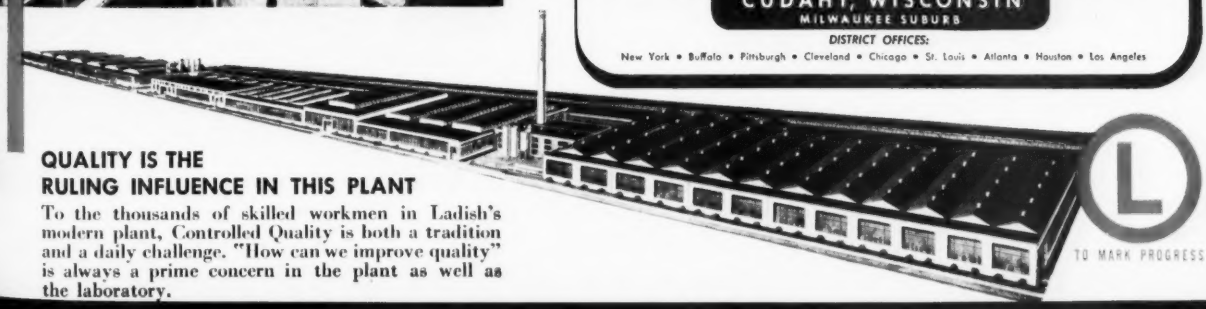
MILWAUKEE SUBURB

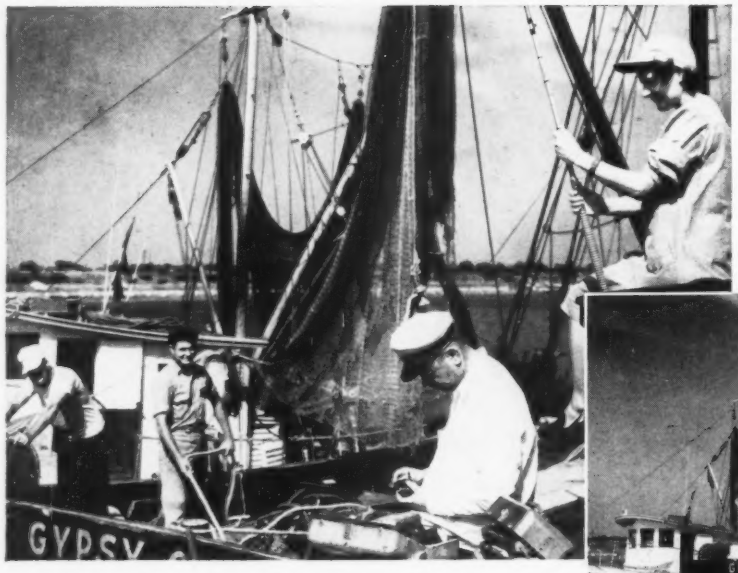
DISTRICT OFFICES:
New York • Buffalo • Pittsburgh • Cleveland • Chicago • St. Louis • Atlanta • Houston • Los Angeles



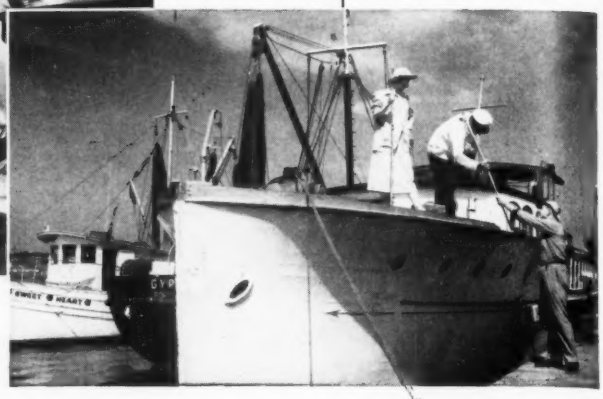
QUALITY IS THE RULING INFLUENCE IN THIS PLANT

To the thousands of skilled workmen in Ladish's modern plant, Controlled Quality is both a tradition and a daily challenge. "How can we improve quality" is always a prime concern in the plant as well as the laboratory.

TO MARK PROGRESS



From the docks along the Brazos at Freeport, pleasure boats take off for the deep sea or to inland waterways depending on where the fish are biting.



It's fun to live in TEXAS

Happy workmen are good workmen. Every boss knows that.

And outdoor recreation provides fun the year-round on the Texas Gulf Coast.

This is not a *turista* advertisement. Rather it is addressed to textile executives who themselves like to fish but, more importantly, recognize the fact that the workers in the mill like fun, too, along with their pay checks.

But having fun living in Texas is only one reason why you should locate, relocate or expand your textile operation to the Texas Coast country.

Down here there is a super-abundance of basic materials: 28% of the Nation's cotton, 21% of the wool clip, 84% of the mohair, and the synthetics industry is growing by leaps and bounds.

Fuel? The cleanest and most economical of them all — natural gas. (Texas has 58% of the U. S. proved reserves).

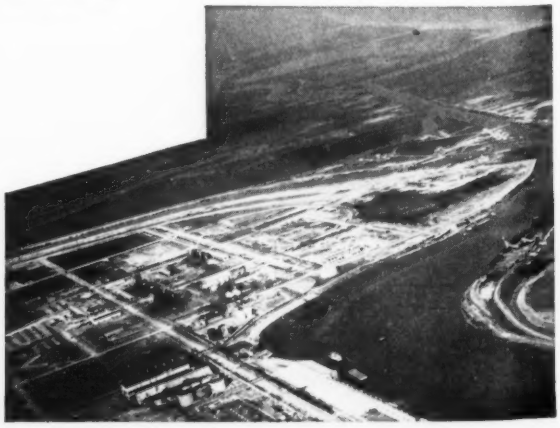
Land, water and air transportation direct to all points in two hemispheres. Intelligent, cooperative labor, plenty of good water, plenty of sunshine, plenty of room.

Put your textile plant on the Texas Gulf Coast where you can make good money—and have fun at the same time.

Send for a Survey of the Texas Coast Country

On request, we will prepare for your company a carefully engineered and confidential survey of the Texas Coast Country individualized to fit your particular problem. No cost, no obligation. Address Research Department, Houston Pipe Line Company, Houston, Texas.

The huge Dow Chemical plant sprawls over hundreds of acres at Freeport.



HOUSTON PIPE LINE CO.
Subsidiary of Houston Oil Company of Texas GEO. A. HILL, JR., President
Wholesalers of Natural GAS

"One of a series of advertisements which have appeared recently in national publications. Purposes to bring the varied resources of Texas to the attention of the Nation's industrialists."

Harry E. Homeyer, pilot, and E. H. Williamson, at patrol airplane of contractor servicing gas lines in Pennsylvania and New York

Aerial Pipe-Line Patrol Saves Expense on Eastern Line

by E. H. Williamson*

THE management group of New York State Natural Gas Corp. has for some time been interested in the feasibility of patrolling long gas-transmission lines by aircraft.

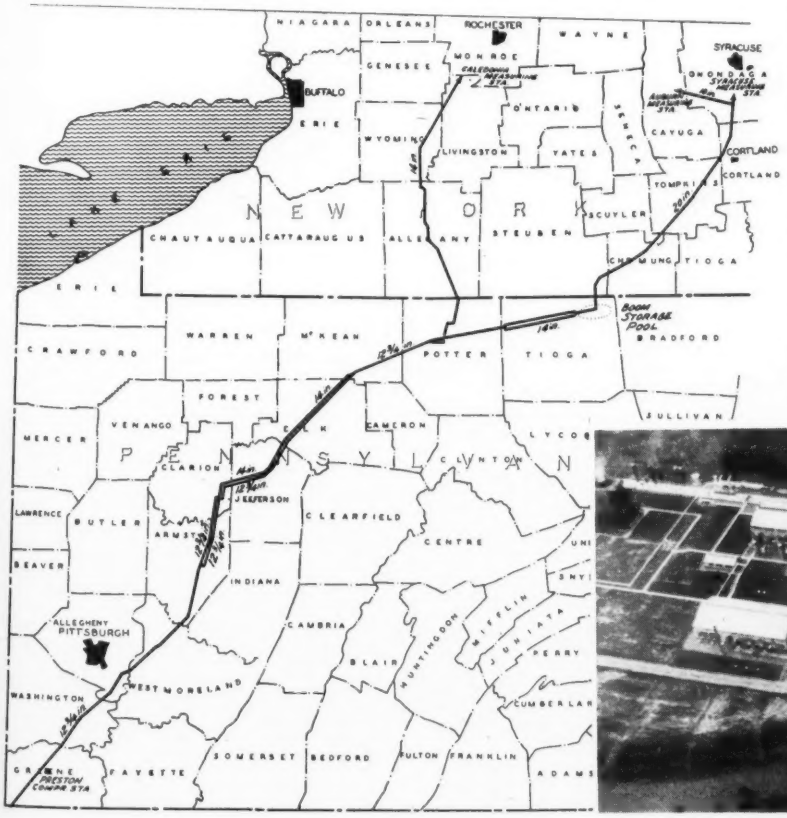
Of course, it was well known to this group that Mississippi River Fuel Co. has used such a patrol since 1931, and apparently with a considerable degree of success. The few available papers on the subject having been read, it was with a great deal of interest that we talked personally with C. B. McMahan of Monroe, La., early in February of this year. McMahan proved a convincing salesman in the office, and it was agreed that he should be given the opportunity to prove his claims by making four round trips over New York State's transmission system. After the first trip there was no serious discussion of anything other than entering into a year-round contract for periodic coverage of the lines by air.

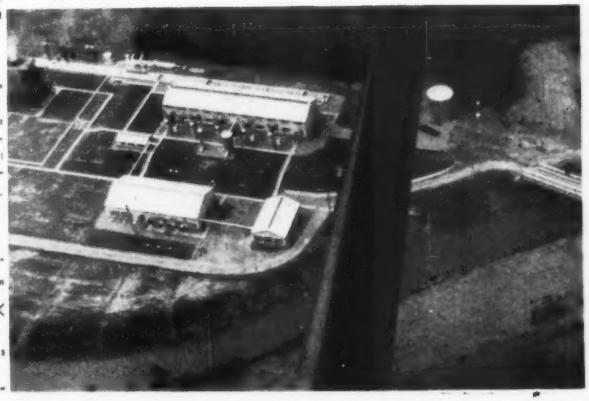
New York State's lines traverse practically every kind of terrain which could possibly be encountered in the East. Portions of the system are through the rough, choppy hills of southwestern Pennsylvania, where frequent landslides develop; then through the highly industrialized and heavily settled areas adjacent to Pittsburgh. North of Pittsburgh the terrain consists of intermittent farms and wood lots of a moderately rolling character. Practically all of western Pennsylvania is heavily mined for coal, both by deep and strip-mining methods. Through North Central Pennsylvania and southern New York, the right-of-way consistently traverses remote wooded sections of a rough, mountainous nature. The remainder of the right-of-way in New York consists mostly of glacial drift country where streams are apt to change course frequently, thus leaving a pipe line swinging in the air or in two.

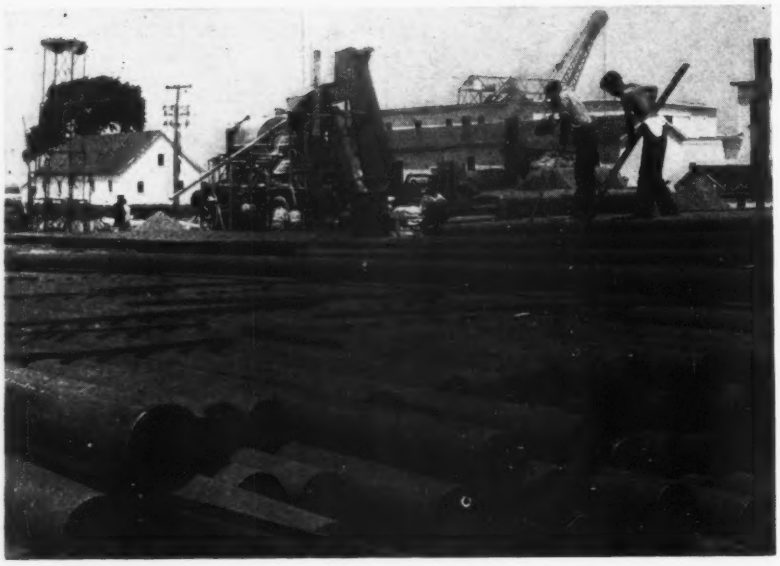
It is readily apparent, then, that lines in this area are constantly subject to landslides, washes, surface subsidence due to mining operations, damage from stripping operations, new construction of all sorts, and numerous other types of encroachments on the right-of-way. All of these items, of course, can be observed beautifully from the air. Slow leaks are also easily spotted from the air, especially in the spring.

Inasmuch as the work consists of hundreds of miles of low-altitude flying, usually not more than 100 ft. above the hill tops or 200 ft. above the line through gentle country, absolute perfection in equipment and pilots is required.

Left: Map showing system of New York Natural Gas Corp. patrolled by airplane. Below: Preston compressor station, Greene County, Pennsylvania, on New York Natural Gas Corp. line seen from patrol airplane







Coating-yard scene showing stock pile of pipe

Socony-Vacuum Laying Lines In Maine and Pennsylvania

by G. F. Brigance

SOCONY-VACUUM OIL CO., INC., has let contracts for the construction of two products pipe lines which have been under consideration for the past several years but which have been delayed by the inability to obtain pipe and other materials.

One is an 8-in. line extending from Malvern, Pa., to Binghamton, N. Y., and it will have four 6-in. branch lines connecting to Socony-Vacuum bulk terminals in Reading, Allentown, Hazleton, and Exeter, Pa.

At Malvern, this 8-in. line will branch off from the present Socony-Vacuum pipe-line distribution system which extends from Paulsboro, N. J., to Midland, Pa., and will also connect at Binghamton, with the present pipe-line distribution system, which extends from Buffalo to Syracuse and also to Binghamton via Seneca Falls and Ithaca, N. Y.

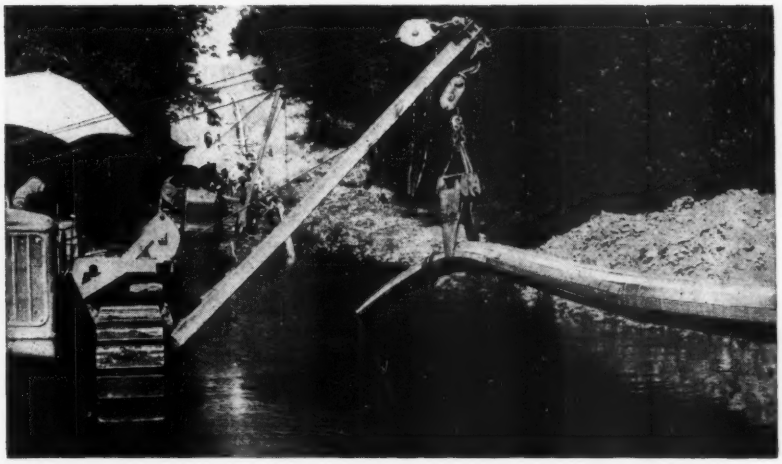
The new line will thus enable the company to supply products to all areas in New York and Pennsylvania from its refineries at Buffalo or at Paulsboro.

No particularly difficult engineering problems are involved in the construction of this line except some of the river crossings, which are complicated by the fact that the state of Pennsylvania has a stream cleanup program in progress which requires the pipe-lines crossings to be buried to unusual depths in the rivers. The principal rivers crossed by this line are the Schuylkill and the Lehigh.

The terrain traversed by this line varies from the level farm lands of Chester and Montgomery counties in Pennsylvania to the rough and rocky

The author is chief engineer of the pipe-line department of Socony-Vacuum Oil Co., Inc. He started with Magnolia Petroleum Co., a Socony-Vacuum affiliate, in 1922 as an engineer in Dallas. In 1940 he was transferred to Socony-Vacuum headquarters in New York, and was later loaned to the Government as construction superintendent on the WEP line. He returned to Socony-Vacuum in 1944 in his present capacity. A graduate of Texas A. & M. as a civil engineer, he was with Atlantic Refining Co., in Dallas, and Amerada Petroleum Corp., Tulsa, before joining Magnolia.

Left: Rocky ditch line after shooting and before cleaning out on the Portland-Bangor line. Right: Trenching machine operating in Maine



Left: Laying 6-in. somastic-coated pipe. Above: Lowering in a creek crossing in Maine

Pocono Mountain regions of Lehigh, Carbon, and Luzerne counties which cover the anthracite coal area.

The contract for the construction of the 8-in. line has been let to the Midwestern Constructors, Inc., of Tulsa.

There will be one booster pumping station constructed on this line and two booster stations added to the existing New York distribution system. All stations will be equipped with electrically driven, vertical triplex pumps.

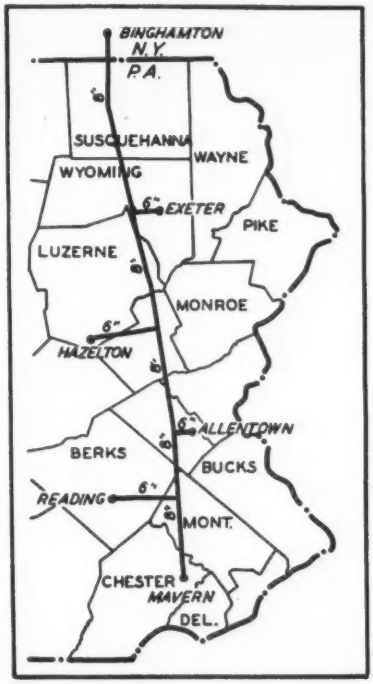
The other pipe line for which Socony-Vacuum has let a contract is a 6-in. line extending from South Portland to Bangor, Me., with one pumping station at South Portland. This line will supply existing bulk terminals at Hallowell and Bangor and a new terminal which is now under construction at Auburn. In each case the main line is to be carried through the plant properties which will eliminate the necessity for branch lines.

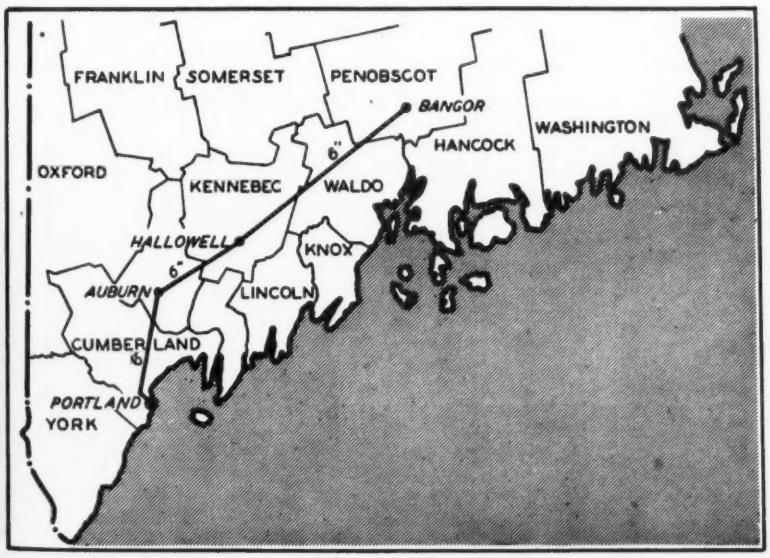
Products for this line will be received into storage from tankers at South Portland and taken from storage into the pipe line.

The most difficult construction problems presented on this line are the unusual amount of hard rock to be excavated in trenching and the heavy timber to be cleared from the right-of-way.

The line will cross the Androscoggin River south of Auburn and the Kennebec River at Hallowell. At the point of crossing the Kennebec is navigable and it was necessary to go below the barge channel in solid rock.

The terrain traversed by this line is mostly the rock-bound rolling hills found all along the Maine coast and is interspersed with numerous fresh-water lakes which were dodged by the survey.





Above: Route of the Binghamton-Malvern 8-in. line. Four 6-in. branch lines connect to bulk terminals in Reading, Allentown, Hazleton, and Exeter. Left: Route of the 6-in. line extending from South Portland to Bangor, Me.

The contract for the construction of this line has been let to Associated Contractors & Engineers, Inc., of Houston.

Both the Pennsylvania and the Maine line will be coated with Somastic coating by H. C. Price Co. at railhead points. Four coating sites are to be used in Pennsylvania and three in Maine.

Both lines are expected to be in operation in time to supply heating oil for the 1948-49 season.

Drifting Submerged Towboat Believed Cause Of Break in Pipe-Line River Crossing

by N. A. Saigh*

A FREAK accident last March is believed responsible for the breaking of a 14-in. line laid across the Mississippi River during the summer of 1947. The line, laid for Memphis Gas Co., now a part of Texas Gas Transmission Corp., broke near Greenville, Miss., 4½ days after the river tug "Natchez," one of the largest on the river, struck a bridge pier at Greenville, and sank.

On March 4, at 9 p.m., the Natchez was towing a string of barges, loaded with oil, upstream, with St. Louis the destination. The towboat was the property of the Federal Barge Line but was on charter to Standard Oil Co. of Ohio. As the tow reached the Greenville-Lake Village bridge, the Natchez was caught in a whirlpool which caused it to become disengaged from its tow, and to hit the bridge pier second from the Arkansas side of the river. The boat capsized and sank with a loss of several lives. The river stage was high at the time, the depth of the water being in excess of 100 ft.

Sensing the possible danger to its 14-in. line, which was laid in a downstream catenary approximately 1,400 ft. below the bridge, Texas Gas dispatched two men to the river to observe any damage which might occur. Also present were U. S. Engineers from the Vicksburg district. On the morning of March 9, at 9 a.m., the company observers reported that large bubbles were seen rising above the pipe location a few hundred feet east of the Arkansas side of the river, and at 11 a.m., 2 hours later, they reported a huge geyser at the same spot spouting water in a column 200 ft. high. The break in the line evidently became clean at this time. The tug obviously drifted along the bed of the river until it came in contact with the pipe line, where its downstream movement was only temporarily delayed.

Efforts were made as quickly as possible by U. S. Engineers to locate the position of the boat, but were unsuccessful. It is thought that the boat finally continued on its downstream path after it loosed itself from the line. In support of the theory, the river was recently dragged for a distance of 2½ miles downstream from the bridge. This effort resulted in no information relative to the position of the sunken boat in the distance traversed and it is presumed now that the craft has been completely covered with sand. River men of long experience are of the opinion that the boat moved several miles downstream from the bridge and finally was deposited in a huge sinkhole in the bed of the stream.

When the 14-in. submarine crossing was installed in the summer of 1947 in a downstream catenary, the land approaches were laid on the surface of the ground without any cover and with sufficient slack to allow for any movement of the river line toward its final settling point.

Designed by Company Engineers

The line was designed by company engineers and was built of ¾-in.-wall-thickness steel weighing 106 lb. per lineal foot. The joints were welded by the electric weld process, each weld requiring 21 beads. Laboratory tests were made on sample welds to insure perfection and company engineers maintained rigid inspection throughout the welding operation. Sufficient time was allowed so that each weld was cooled thoroughly before the line was lowered into the water to avoid crystallization of the metal. The pipe was given proper insulation and special care was exercised in lowering the line by the use of lowering barges.

The line was in successful operation throughout the winter months and gave no trouble until the day of the break. The fact that it broke because of an unusual strain is supported by the theory that the contact of the towboat and the line caused a sharp impact resulting in the downward movement of the pipe and imposing sufficient tension to break the line, causing the free ends to engage in a whip-like motion downstream.

Since the break was close to the Arkansas shore, that portion of the line maintained its approximate position, but the whipping action caused the free end on the Mississippi side to move several hundred feet downstream. There is evidence, too, that the Mississippi end of the line either buckled or was crushed by the weight of the boat since an application of 400 lb. of gas pressure to that end produced only large bubbles on the surface of the river, whereas a similar pressure applied at the Arkansas end resulted in a huge column of water rising 200 ft. into the air. From the data obtained, it must be concluded that the pipe line broke by virtue of direct contact with the towboat.

The Arkansas side of the pipe line has been removed and efforts are

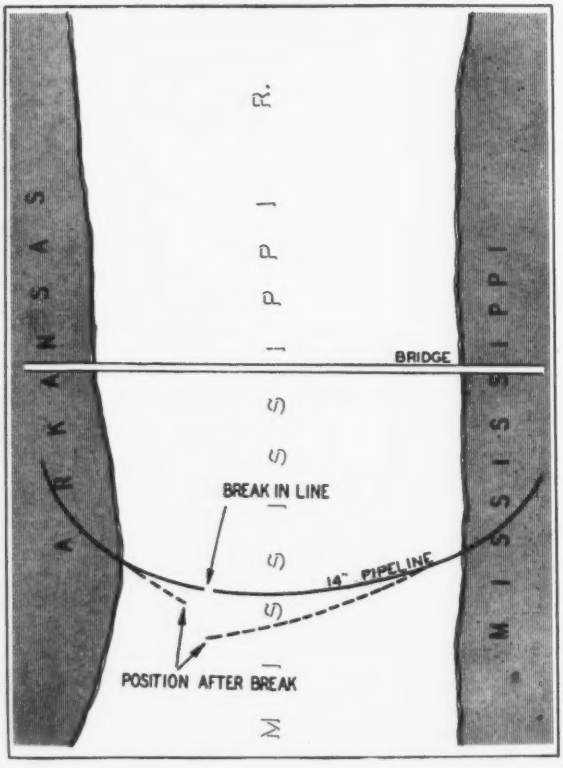
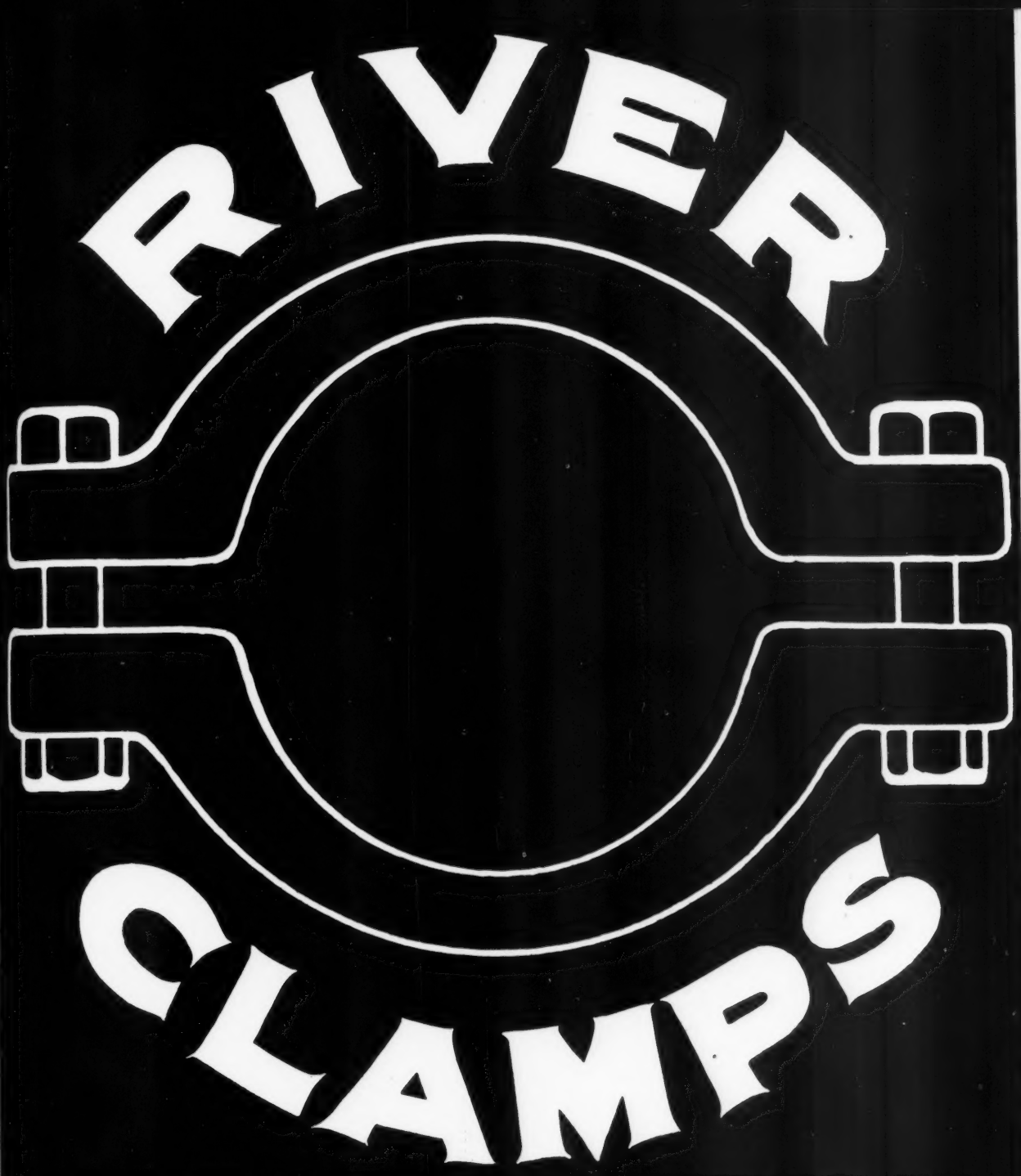


Diagram showing position of 14-in. pipe in the Mississippi River before and after the break following the sinking of the tugboat Natchez

*President, N. A. Saigh Co., Inc., San Antonio.



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being made to recover the remainder of the line from the Mississippi shore either by the direct-pull method, or by the use of barges and derrick cranes.

Texas Gas Transmission Corp. has contracted with N. A. Saigh Co., San Antonio, for the installation of two 12-in. and one 14-in. lines across the river, plus additional land lines of 26-in. diameter to existing headers. Each of the lines across the river will be about 2,500 ft. in length and will be laid 250 ft. apart in the middle of the stream. The lines will converge toward the shore until they are only 40 ft. apart. They will then be tied into a 26-in. header from which the land lines on each side will be laid several thousand feet to existing headers on the land side of the levees. Upon completion of this project Texas Gas will have seven lines across the river at this point.

The new lines are being laid several hundred feet downstream from the site of the broken 14-in. line. These lines are being installed by the use of barges in the customary manner and it is estimated the lines will be completed during September when the river stage should be favorable. The completed crossings will reestablish the balanced capacity of the system across the river.

Trans-Arabian Line Will Be Outlet for Crude

(Continued from page 167)

schedule will delay the completion date at least eight or nine months.

Suspension of pipe shipments necessarily required diversion to other world trade routes of a fleet of fifteen 10,000-ton freighters, assembled on bare-boat and other charters, and being operated on a schedule averaging one ship per week, which the Isthmian Line originally thought would keep them busy continuously for more than 2 years. Meanwhile, Tapline is accumulating a vast amount of materials and supplies, other than pipe, at various Atlantic and Pacific ports, which is presenting a perplexing storage problem. We can do very little about it until OIT resumes validations of pipe export licenses and we can instruct Isthmian to reassemble a fleet.

DeGolyer Inspects Fields

During World War II, E. DeGolyer inspected the oil fields of the Middle East for the United States Government and stated that the center of gravity of the world's future production had shifted from the Western Hemisphere to the Middle East. When he made the statement, the entire Middle East was producing an average of 304,000 bbl. per day. In 1947, it had climbed to an average of 832,000 bbl. This year's daily average will pass the million-barrel mark and may catch up with Venezuela. In 10 years, the proved reserves have increased from less than 5, to more than 30 billion barrels, or now over 50 per cent of the world's total. Aramco alone has proved reserves of approximately 7 billion barrels discovered with only 11 wildcat wells. At present there are only 65 wells, averaging approximately 7,000 bbl. daily each, all of which are flowing. Field pressures are so conserved that it is believed that the oil will be produced by natural flow without pumping.

It is questionable whether or not during the next few years the United States can develop enough new domestic production to meet its own increasing consumptive needs, and whether Venezuela and other South American countries will be capable of taking care of a substantial portion of the prospective additional demand by the world's consumer countries. Therefore, the United States will have either to use its aboveground crude stocks, or curtail its gasoline and fuel consumption, unless facilities are made available for supplying Europe from the Middle East.

300,000 Bbl. Throughput

Now, returning to the particulars of the pipe line. Initially, Tapline will have a throughput capacity of 300,000 bbl. daily with six pump stations at average intervals of 180 miles apart. This will require 323,000 tons of steel for pipe, oil tanks, terminal facilities, and all other structures. The throughput capacity can be increased to 500,000 bbl. daily by the installation of six intermediate booster stations and some additional oil tanks and terminal structures which will require only 42,000 tons of steel. It would require 102 additional modern, 16,000-ton, T-2 type tankers to maintain a daily movement of 500,000 bbl. from the Persian Gulf to the Mediterranean and 565,000 tons of steel plates and shapes to build them and provide fa-

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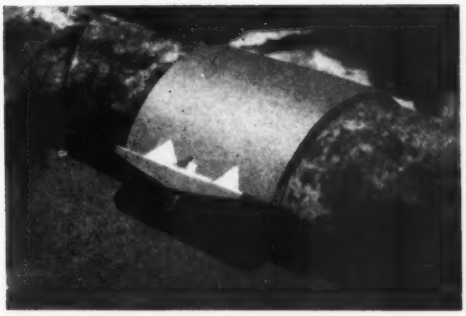

Grip-Tite Pipe Line Anchor Assembly with Stearns Pipe Saddle was originated and designed especially for protection to pipe coating and for permanent holddowns for all kinds of pipe line construction, costing only a fraction of cast iron or concrete weights. It is field proved beyond any doubt. No heavy equipment is needed for installation—saves time, labor and other handling expense. Grip-Tite affords protection from heavy weight damage during installation. An expansion joint pad provides additional protection to pipe coating.

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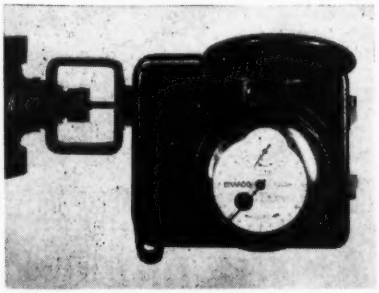

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The features unique in the Enardo shut-off valve are two independent actions — (1) The main spring is used only for driving the timing mechanism, thus assuring accuracy. (2) A separate spring trips the valve control lever. Very satisfactory for controlling low pressure liquid and gas lines.

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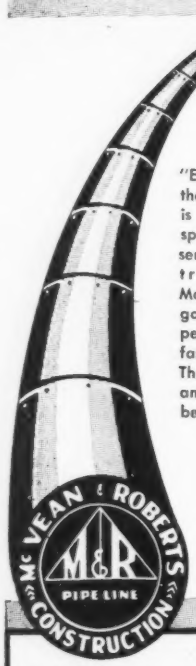

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cilities on the Persian Gulf to load them. Moreover, each tanker would have to travel about 3 weeks to make the round-trip voyage. Therefore, the pipe line will eliminate 930,000 tanker-travel miles per month and save $1.35 per ton, or 18 cents per barrel, of the cost of Arabian crude, represented by the single item of Suez Canal tolls. The canal would be literally choked with slow-moving tankers. And what would happen if one should catch on fire or a few days' traffic jam should occur?

Other major pipe-line outlets for Middle East crude to Mediterranean ports will follow the Tapline project on the following delivery schedule of firm contracts for pipe:

1. Middle East Pipe Line Co., Abadan to the Mediterranean, 36-34-in. line, capacity 535,000 bbl. daily;

2. Gulf-Shell pipe line, Kuwait to the Mediterranean, 30-32-in. line, capacity 300,000 bbl. daily; and

3. Iraq Petroleum Co., Kirkuk to Tripoli, 30-32-in. line, capacity 300,000 bbl. daily.

This gigantic pipe-line-construction program will consume a period of probably 6 years and will provide an aggregate total pipe-line outlet to the Mediterranean for nearly 1½ million barrels daily. For Middle East countries, it will be a junior Marshall plan financed entirely by private capital. In the August 19 number of The Oil and Gas Journal, and elsewhere in this issue, articles by others describe Tapline's construction characteristics in more detail.

Conclusions

In concluding this article, I shall mention only the more important unique features of the Tapline job. They are as follows:

1. Shipment of the heaviest tonnage of materials and supplies, and the largest number of men, over the longest overseas voyages yet attempted for a single project by any government or any private enterprise in peacetime.

2. Shipment of large-diameter pipe in nested units of two lengths each which reduces transportation cost approximately 50 per cent.

3. Position-welded lengths of pipe by the union-melt process, into strings 93 ft. long, before hauling same inland from the seaport construction base camps and forwarding yards to locations along the route, effecting a reduction of 66⅔ per cent in manual welding.

4. Use of mammoth-size motor trucks weighing 15 tons and capable of hauling entire railway freight carloads of 50 tons or more.

5. Usage of a brand-new type of aerial cableway about 3 miles long and traveling "Skyhooks," instead of the conventional lighters, or the construction of a pier approach 2½ miles long, for handling pipe and other cargo from ship to shore.

Pump Station Design

(Continued from page 173)

gage board and control the air pressure to the diaphragm of a 10-in. series 600 steel, pressure-control valve, which is located in the station discharge piping. In the event of a decreasing suction pressure (normally 15-20 psi.) the air controllers tend to close the 10-in. control valve thereby throttling the stream enough to maintain a set suction pressure. Likewise, in the event of increasing discharge pressure the controllers tend to close the 10-in. control valve, which throttles the stream to maintain the set discharge pressure.

The suction control is overriding in order to maintain a positive suction pressure at the pumps at all times. From the above it may be seen that each station follows the other stations, thereby balancing the line. It will be noted that the Mason-Neilan control equipment does not start or stop any of the units; the pressure is controlled between two set points after the units are operating.

Since the pressure controllers do not shut the pumping units down, additional protection is needed to cover two emergency conditions; namely, power failure at Corsicana or the accidental closing off the line at some point, in the event of either line flow ceases. When the power fails at Corsicana, the controls at the other stations throttle the stream and maintain the set suction pressure, but the line flow has stopped and the suction pressure falls to zero. At this point a mercoid switch sounds an alarm which warns the operator, who stops the pumping units immediately.

In the event of the line being shut off at some point the control valve will throttle the station discharge pressure to the setting of the instrument, but has no control over the pressure between the pumps and the control valve itself. To prevent sub-

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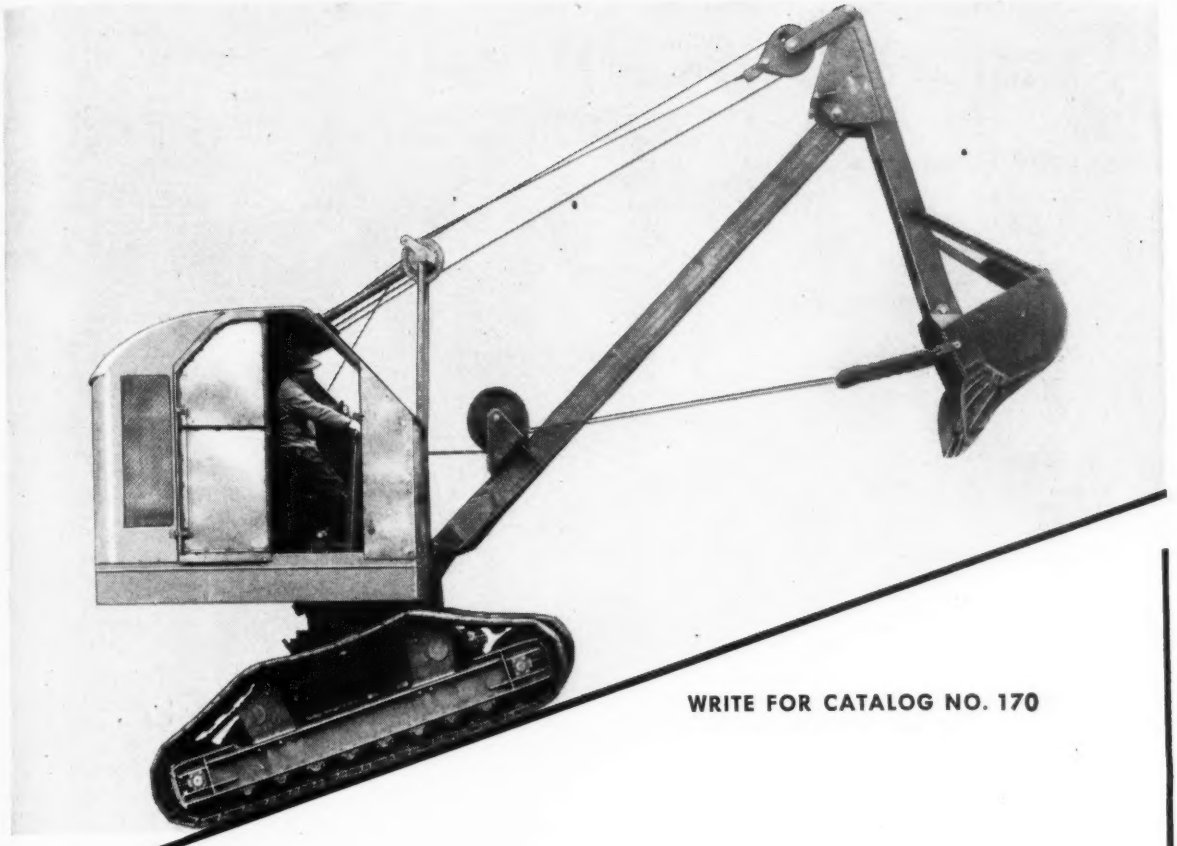

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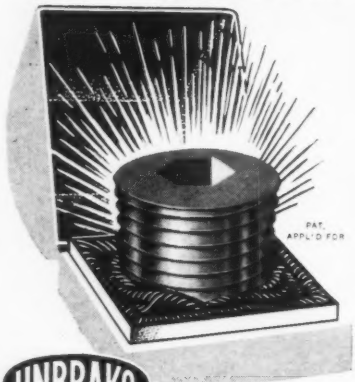

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jecting the pump cases and a small portion of the station piping to any overpressure, mercoid switch is installed, which shuts all the units down. Should the supply air fail, an alarm warns the operator, who then operates the control valve manually until the air service is restored.

Corsicana station, which is the originating station on the 20-in. line, has two features worthy of special note. The 20-in. line handles only one grade of crude oil, which is a mixture of sweet and sour crudes. It is desirable to deliver to the refineries a crude having uniform sulfur content throughout the year, hence it becomes necessary to control the rate of feed-in of each crude from the tank farm. This is accomplished with suction pumps and a meter-control setting located on the tank farm. This location is approximately 1,800 ft. from the main pump station.

The sour crude is handled in four 120,000-bbl. floating-roof tanks with a 20-in. line to a 10 by 12-in. suction pump and the sweet crude is handled in three 55,000-bbl. and three 80,000-bbl. cone-roof tanks with a 20-in. line to an 8 by 10-in. suction pump. A No. 14 Fischer and Porter Flowrator is installed on the discharge side of each pump. A 12-in. air-operated diaphram control valve is installed on the discharge side of the Flowrator on the 8 by 10-in.

Instrument Setting

The flow in barrels per hour as measured by the meters is transmitted electrically to a ratio-control instrument, which controls the air pressure to the diaphram control valve. The instrument is set to the desired ratio of sweet versus sour crude and this ratio is maintained by the opening or closing of the control valve by the ratio controller. The suction pump on the line equipped with the control valve has a higher head characteristic than the other pump to enable it to pump into the main suction header the desired amount of crude to maintain the correct ratio. In addition to serving as a control on crude mixtures, these pumps supply a positive suction pressure to the main units, and by virtue of being located near the tanks rather than at the station, the tanks can be pumped to a low level, and only one line from the tanks to the station is necessary. Another feature of the Corsicana station is the use of a No. 20 Fischer & Porter Flowrator for metering the full stream going into the 20-in. line. This meter is located in the suction line to the main pumps and indicates and records in barrels per hour.

The line was tested hydraulically with water at 800 psi. Both the water used in the test and the oil used to displace the water were pumped into the line at a very slow rate, with a batching or plug-type scraper, to make sure that all air was displaced before the line was put into full scale operation. The test and initial starting of the line was a complete success.

The writer wishes to express his appreciation to J. G. Norton, chief mechanical engineer, for his comments on the article and to A. W. Frey, assistant superintendent of maintenance, and J. S. Myers, chief engineer at Conway station, for preparation of the photographic work.

Electrical Features on Humble's Pipe Line

(Continued from page 175)

locked to insure that only one will remain open at a given time.

At Baytown station the control desk also mounts pushbuttons for the control of each suction booster pump delivering product from tankage to the station manifold. At each station the desk mounts a pushbutton for the control of a utility pump operating in connection with the tankage.

In this desk the various pushbuttons and the lights for supervision of auxiliaries, position indication of valves, and identification of pro-

THE AUTHORS

F. O. STIVERS

F. O. Stivers is located in the Houston office of Humble Pipe Line Co. as senior mechanical engineer. A graduate of Purdue University, he joined Humble in 1945.

J. E. Barbee is an electrical engineer in the communications and electrical department in the Houston office of Humble Pipe Line Co. A graduate of Texas A. & M. in 1931, he joined Humble in 1934.

Merritt A. Hyde, Jr., has been a member of the headquarters engineering department of Westinghouse Electric Corp. at West Pittsburgh ever since graduation from Case. He specializes in petroleum-industry electrification.

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tective relay functions, are appropriately located in a simplified diagram of the station piping. The piping design is applied to the under side of a transparent plastic panel which forms the desk top, giving a permanent top surface that is smooth and free from any projecting parts.

The electrical switchgear installed at each station consists of (1) an outdoor main breaker installed at the transformer substation, on the secondary side, to feed the 2,300-volt pumping-station bus, and (2) a set of indoor metal-clad switchgear. The latter provides control of the outdoor main breaker, also surge protection for the pump motors. It also provides autotransformer starting for the pump motors, auxiliary relaying for sequence and protective control of the pump units, and distribution for 230-volt auxiliary power and 115-volt lighting on "nonessential" circuits supplied through transformers connected on the load side of the main breaker.

Switchgear of the metal-clad type was installed because it affords the ultimate in circuit protection and in operator safety. Another important advantage in pipe-line service is interchangeability of circuit-breaker units. This permits any unit to be replaced by a common spare with minimum downtime, allowing inspection and maintenance work to be done on the breaker unit with minimum interruption of pipe-line operations.

As previously stated, the station building is separated into areas classified as hazardous or nonhazardous when consideration is given to the possible presence of explosive vapors. Leakage of pressure gages or other instruments mounted above the control desk may result in explosive vapors entering the normally nonhazardous areas. For protection under these conditions, there is provided on the control desk an explosionproof pushbutton which will open the main breaker in the outdoor electric substation. In this manner, all nonexplosionproof circuits may be deenergized at a point outside the station building.

Obviously, under emergency conditions, lights and blowers might be required for night work and for the removal of explosive vapors from within the station building. For this contingency, all station lights, blowers, and exhaust fans are on circuits using fixtures and installation methods which are approved for use in hazardous locations. These circuits are powered from a separate bank of transformers connected ahead of the main outdoor breaker so that service on these particular explosionproof circuits will not be interrupted except by complete power failure.

Main-Line Pump Unit Failure

All types of main-line pump unit failure, except when due to complete power outage, are brought to the operator's attention immediately, and at three different locations on the station property. Outside of the building is a siren, in the pump room is a flashing light, and on the control desk are small individual indicating lights which show the cause of failure by identifying the particular safety device which has functioned.

Complete power failure causes the sounding of a loud sharp blast on an air horn located atop the station building. An auxiliary air tank, connected to the main compressor tank and horn by a three-way solenoid valve, operates the horn for approximately 45 seconds or until the air supply in the auxiliary tank is exhausted. When deenergized, the solenoid valve opens the line between the auxiliary tank and horn but cuts off the supply from the main compressor tank. This method prevents loss of air from the main compressor tank when the air horn is sounded.

In considering the installation of a control-room telephone, which would be safe under emergency conditions, it was found that the standard hazardous-location instrument was available only in the wall-mounting type which could not be easily adapted to use on a desk. It was therefore decided to install in the control room a standard desk instrument with con-

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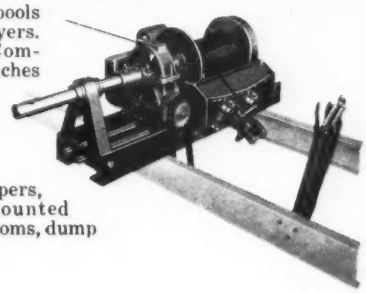

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ventional wiring, utilizing floor outlets. This circuit is controlled through a transformer-type relay having two single-pole double-throw mercury switches, mounted on a pole where the overhead telephone line enters the underground system into the station, which location is nonhazardous. This relay is energized directly from the 115-volt system which receives power from the load side of the main outdoor breaker. Normally the relay is energized connecting the telephone instrument to the telephone line; but when the relay is deenergized as by opening of the main outdoor breaker, the telephone instrument is disconnected from the line and the telephone instrument is shorted and grounded.

An additional telephone instrument is installed on a pole outside the station for use when the control-room instrument is disconnected. Where magneto-type telephones are used, an additional transformer-type relay is required for the circuit supplying the transmitter battery.

These facilities permit the exacting procedures of product-line-station operation to be carried out with minimum personnel. They also contribute to the coordinated operation of stations and delivery terminals under the direction of the system dispatcher in such manner as to attain the most effective operation of the line as a whole.

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Altimeters

Creole Constructs a Big-Inch Line

(Continued from page 179)

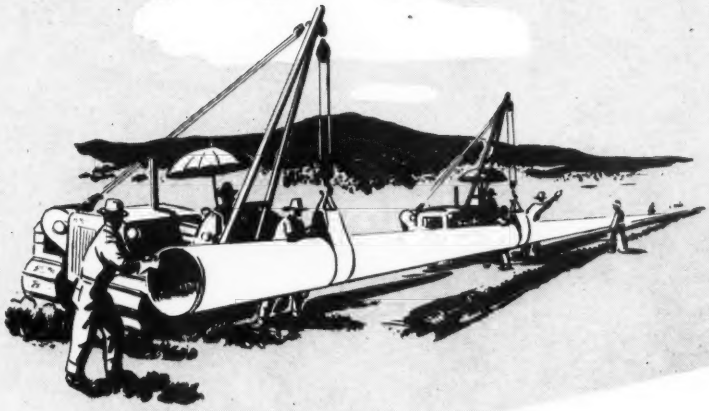
and simply bent to follow the contours. Present lines are laid on top of the ground without protective coatings, and some as old as 10 years still show mill scale. Some corrosion naturally occurs at the point of contact between the pipe and the ground, and particularly at any areas of high moisture. At such locations, lines are generally placed aboveground on concrete or timber sleepers, which has most effectively ended the corrosion at the particular bad location. This method has been followed in the present line construction, and the only difficulties encountered have been in bending the 24 and 26-in. pipe to fit the contours. Using a mechanical bending machine, bends not exceeding 8° in a 40-ft. pipe joint are obtainable without difficulty and without buckling or wrinkling.

The line construction throughout is all welded, and on an average five beads are run with each weld. A stringer bead is run with No. 5 Fleetweld rod; No. 1 and No. 2 filler beads with Fleetweld No. 85 rod, and the final two passes with No. 5 Fleetweld rod. In the construction of this line, high-speed submerged arc welding is also being used for double jointings. This weld includes a stringer bead by hand, with No. 5 Fleetweld rod, plus two passes with a submerged arc machine: The first, at 450 amp., and the second at 600 amp. both with 7/32-in. coiled wire electrode, equivalent in characteristics to Fleetweld No. 85 rod. This high-speed submerged arc weld has resulted in material labor savings, in that the two-pass weld is run in from 9 to 10 minutes. This machine has resulted in a reduction of the number of the imported welders from the United States and accomplishes an estimated savings of $600 per day in the actual construction work.

Laboratory tests of the high-speed welding process disclose welds of an excellent character, having strength in excess of the parent pipe metal.

As of this date, of the total of 145 miles of the line, approximately 75 miles are complete, and laying is continuing at a rate of from 1¼ to 1½ miles per day. The entire main line, Ule to Amuay, is now scheduled for completion, including the submarine line which will be the last feature completed, by December 1, which will permit initiation of line operations prior to the first of the year.

Through this pipe-line system it is planned to transport oils of widely



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varying characteristics, ranging from the lightest in the Tia Juana medium class, having a gravity of 28.6° and a viscosity of 135 S.U.S., down to certain heavier crudes, having a gravity as low as 16° A.P.I., and viscosity as high as 1,800 S.U.S. To handle these widely varying characteristic oils, the station design required careful study.

The two pump stations, Ule and Dabajuro, are more or less of identical design with the exception of tankage. At Ule station eight 150,000-bbl. floating-roof tanks are now complete, and four additional will be constructed upon delivery of materials, which represents a total storage at the initial station of 1,800,000 bbl.

This station will include seven Cooper-Bessemer model LS-8 gas-diesel engines, each rated at 1,000 hp., and each directly connected to an 8 by 24-in. Worthington horizontal double-acting triplex pump, rated at 55,000 bbl. per day at 1,000 lb. pressure. In addition, a Cooper-Bessemer model JS-6 gas-diesel engine with 350-kw. generator will be installed as a standby source of electrical power. The normal electrical power supply for Ule station will be provided from the Creole steam-turbine generator facility, located a short distance from the pump station.

In order to obtain maximum volumetric efficiency of the large triplex pumps, two Byron-Jackson single-stage booster pump units have been installed at a central location within the tank farm, and will discharge to the station manifold, thence to the suction of each of the triplex pumps, which will be operated with inlet suction pressures varying from 10 to 15 lb. These high inlet pressures are particularly necessary in view of the program of batching through the line certain of the low-gravity, high-viscosity crudes. Such inlet pressure will result in higher volumetric efficiency.

The pump-house building is designed in accordance with San Francisco earthquake standards, and includes a heavy cathedral arch, all-welded rigid frame, and double-course concrete-block sidewalls. A firewall between pump and engine rooms is included and exhaust ventilation is provided from both pump room and engine room. Filter sections are installed beneath windows in the building sidewalls, and large 60-in. diameter fans discharging from the respective rooms of the pumphouse are designed with a view of maintaining approximately a ½-in. water vacuum in the engine room and approximately a 1-in. water vacuum in the pump room. This type of ventilation was selected because of the severe dusty conditions occurring during the dry seasons of each year. The cooling facilities for the jacket water from the diesel engines includes a Fluor Finfan dry cooling-tower unit, i.e. water is circulated through the fin tubes, and forced air through the fin sections accomplishes the cooling effect.

Other Station Facilities

Automatic temperature control of both engine jacket water and lube oils is obtained with pilot-operated, thermostatic controlled, bypass valves. By dial setting, the desired temperatures of both systems will be automatically controlled and maintained.

The station facilities will also include a separate office building, in which a private office is included for the pump station chief; a gager's office, with necessary equipment, such as centrifuges, hydrometers for check of oil gravities and b.s. and w. content. A third office is provided for the dispatcher. In addition, a large shower, toilet, and locker room is included for the station personnel. All operating instruments on the main gage board within the engine room of the pump house will be extended into the private office of the station chief. Such instruments as outgoing flow meter, outgoing line pressure, inlet pressure to the main discharge pumps, will all indicate on dial instruments within the pump station chief's private office. Automatic alarm signal devices will likewise be extended to the station chief's office, and the entire office is pressure ven-

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tilated, with forced-draft, filtered-air circulation.

The station will also include a separate warehouse and garage buildings, in order to store normal operating parts for the station, and four garages for station vehicles.

The fuel-oil system of the station will include operation of the engines on the gas-diesel cycle; that is, natural gas with a pilot fuel-injection system. The pilot fuel will be crude oil, which will be first centrifuged and then settled in three 125-bbl. elevated cone-roof fuel-oil tanks. A small separate building houses two centrifuges, either of which is of a size adequate to supply fuel oil for the complete station, even on full diesel cycle operation.

The service-tank assembly, in addition to the fuel tanks, also includes an elevated 500-bbl. water tank. Below this tank, aboveground, are two treated-water tanks, in order to provide properly treated water for make-up in the closed engine circulating system. The basic treatment of the circulating water system will be sodium chromate, in that the available water supply after thorough tests only indicates minimum treatment necessary.

The large station pump-house buildings include any number of new features, such as the filtered-air circulation, sound absorbing and deadening ceilings, full design according to San Francisco earthquake standards, in which all machinery foundations are completely independent of the building. Heavy fabricated steel beams bridge over unit foundations, in order that no building columns rest on any foundations of the machinery. In grouting of the engines, a combination of Embeco and Vermiculite sound-proofing grouting was used to reduce the over-all vibration and noise transmission.

Among the various control features is hydraulic control of electric-motor-operated engine governors. In normal operations, the engine speeds will be mechanically set, maintaining an out of step of the reciprocating pumps, and the desired outgoing line pressure will be set at the main switchboard. Then the pilot-operated hydraulic control of the electric-motor-operated engine governors will automatically maintain the set outgoing line pressure.

Interior finish of the pump-house building will be dark-green polished Masterplate floors, a light-green ceramic dado to a height of 8 ft. above the floor, with dark-green ceramic-tile base and trim. Above the tile dado will be off-white, sand-finished plaster. All machinery will be painted a high gloss light-gray color. The outside of the building will receive a sand-finished plaster, which, with native brick architectural pilasters, together with a native tile roof, will furnish a building of excellent architectural aspect.

The main station manifold is set at an elevation above normal ground level, with lines therefrom proceeding to the pump house aboveground.

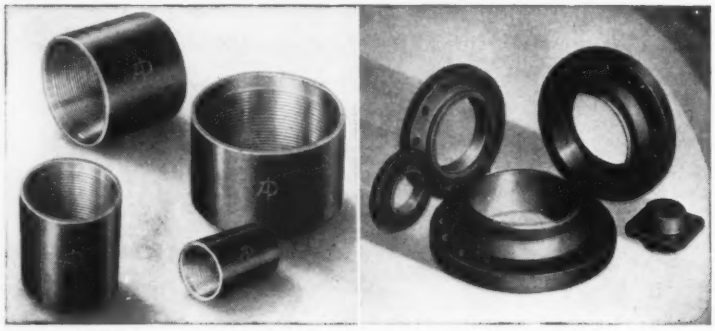
Completely surrounding the pump-house building will be a 30-ft.-wide terrace through which in concrete and sand-filled trenches the oil lines will extend into the pump room.

Throughout the tank farm, all oil lines have been installed in pipe alleyways, in which the suction and fill lines are installed aboveground and on concrete sleepers. This method of aboveground line construction will result in minimum corrosion and future necessity of line repairs.

Inside the crude-oil storage tanks, each includes a spider-piping assembly, permitting stripping down the tank to a minimum, and which will result in no accumulations of b.s. and w. All tank bottoms are coned up to the center a difference of 8 in., and the spider assembly extends to equally spaced points around the circumference of the shell.

Dabajuro station will be basically identical to the initial station at Ule, with the exception that only four 96,000-bbl. cone-roof tanks will be erected. A second difference will be that the station will include two Cooper-Bessemer model JS-6 generating units, each of 350 kw. rating, to provide required electrical power. In other words, a 100 per cent standby for electrical power is provided. This station will basically operate on a

HARRISBURG



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FOR EXAMPLE:

This Type RC-1 Pig, 16" size and larger, is for the usual conditions of:
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Full diameter, 90° laterals
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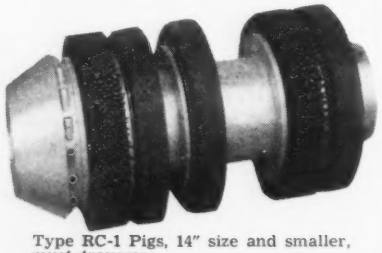

Type RC-1 Pigs, 14" size and smaller, must traverse
Various types of gate valves
Elongated side openings (laterals)
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*Patents pending

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gain-and-loss system; that is, sufficient tankage is provided to maintain maximum outgoing line capacity with medium crudes, while receiving into the station at a lower capacity rate, heavier and more viscous grades of crudes.

The station manifold also includes an automatic check-valve and bypass arrangement permitting tight line operation; that is, when both the incoming and outgoing sections solely include crude oil of one grade, such oil will not flow into tankage, but with a closed manifold system, flow directly into the station discharge pumps and be relayed on to destination.

Major Transportation Problem

This intermediate station at Dabajuro presented a major problem of transportation during construction. No roads were available, and it was necessary to construct a beachhead on the north shore of the gulf of Venezuela. All materials for the station were brought from the United States to the terminal at Amuay Bay, and then transshipped on barges a distance of approximately 60 miles to the beachhead. This was a major problem in handling of materials, in that it was necessary to construct both a temporary dock and also a road from the beachhead to the station site. It was also necessary to construct a complete camp to provide temporary housing during construction of the station. This camp included all facilities from housing facilities for 75 men to mess halls, recreation buildings, as well as a small hospital.

To maintain food supplies during construction, it is necessary each week to fly in to the station site from 3,000 to 5,000 lb. of frozen and perishable foods, in that no other mode of transportation was available. This station site is more or less at an inaccessible location, and the major problem of construction was solely that of transportation.

The terminus of the pipe-line system is at Amuay Bay on the Paraguana Peninsula, where crude-oil loading facilities of the highest known rate are now being completed. The crude-oil terminal facilities include a crude-oil storage farm consisting of eight 150,000-bbl. floating-roof tanks, and eight 150,000-bbl. cone-roof tanks, or a total storage of 2,400,000 bbl.

For loading operations, a diesel powerhouse is being constructed which includes four 1,575-hp. Cooper-Bessemer supercharged diesel engines, each driving a 1,250-kw. General Electric 2,300-volt alternator exciter assembly. As an extension of the diesel powerhouse building, there is being erected a loading pump station, which includes eight Ingersoll-Rand single-stage centrifugal loading pumps, each operated with 500-hp. explosionproof General Electric motors. The combined loading rate to the docks of the pumping facilities is 75,000 bbl. per hour.

In addition, the pump house facility includes four smaller motor-driven centrifugal bunkering pumps, each rated at 2,500 bbl. per hour, two of which are for fuel-oil bunkering operations to vessels at the docks, one for diesel-oil bunkering, and the fourth is a standby for either system. The tank-farm assembly includes a double 24-in. suction line system to each tank, thence to a central tank-farm manifold, from which four 24-in. lines extend to the loading pump-station manifold and thence to the docks. The docking facilities include one materials dock and two finger piers for berthing tankers on either side. In other words, dock facilities will permit handling of four tankers simultaneously.

The diesel powerhouse and loading pump station will be of more or less identical design and architectural scheme of the pump stations at both Ule and Dabajuro; that is, such facility will include a heavy all-welded rigid steel frame, double-course concrete-block exterior walls, inside finish and trim, as well as outside, identical with that of the pipe-line pump stations.

Included in the special control facilities is automatic safety control of the loading pumps from an emergency station at each hose connection

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site on the docks. This control station is connected through a switchboard control panel in the office of the loading pump station; that is, a dial setting establishes and closes the circuit to the electric motors designating the pump delivering to a specified loading connection on the docks.

In the event of an emergency during loading of a tanker, emergency push-button station on the dock will automatically shut down the loading pump and automatically close electric-motor-operated gate valves, which will shut off the flow of oil to that particular berth number at the docks.

FM Radio Equipment

This pipe-line facility will include very-high-frequency (FM) radio equipment for communications and dispatching. The communication system will include five voice channels and two teletype channels between the initial station at Ule, the intermediate station at Dabajuro, and the terminal at Amuay Bay. In order to maintain line-of-sight operation, 300-ft.-high radio towers with directional antennas are being erected. Tests have indicated that, with 400-watt automatic dual transmission and receiving equipment, a highly reliable and excellent communication system will be obtained. Such system provides a greater quantity of communication as compared with an overland metallic system of telephone lines, and at materially lower cost.

The present schedule of construction indicates this complete pipe-line system, at an estimated cost of approximately $37,000,000, will be complete by the end of this year. This new system now places Creole in the position of being an operator of a "big inch" pipe line, with all prerequisites for successful and economical transportation—that is, a large crude-oil demand, enormous reserves for many years' continuous operation on an upward trend in rate, and a system designed and built to the most modern known standards.

BOOKS

MICHIGAN PETROLEUM DIRECTORY. Issued as a supplement to Oil & Gas News, Mount Pleasant, Mich. $2.50.

The first section of this directory lists personnel—chief executives of companies, independent operators, scouts, engineers, state officials, field superintendents, refiners, geologists, and others engaged in petroleum in Michigan. The second section gives cross-listings of companies and individuals engaged chiefly in production, and there follow sections on oil and gas drilling contractors; lease dealers; oil and gas transportation; refiners; supply and service stores; special field services; and boards, association, and agencies.

METAL SPRAYING AND SPRAYED METAL. By W. E. Ballard. Published by Charles Griffin & Co., Ltd., 42 Drury Lane, London, England, and distributed in the United States by American Metallizing Contractors Association, 773 Brownell Avenue, St. Louis 22. 362 pp. $10.

Even though this book is of British origin and leans toward British practice, it constitutes a valuable contribution to the metallizing art in this country. This edition, the third, deletes the descriptions of the historical development of metal spraying. The preface points out that while the book deals with metal spraying only, some of the tools, with only slight adjustments, can be made suitable for nonmetallic materials, but the industrial applications are somewhat experimental at the present time. The book contains 216 illustrations, and 61 tables.

REVIEW OF PETROLEUM GEOLOGY IN 1947. By F. M. Van Tuyl, W. S. Levings, and L. W. LeRoy. Quarterly of Colorado School of Mines, Golden. Published in cooperation with American Association of Geologists. 334 pp. $3.

This is the sixth such annual review. It is based upon information compiled from the literature and from a canvass of leaders in petroleum exploration in the United States and foreign countries. Covered are important events of the year, advances in petroleum geology and contributory fields, including developments in the training of geologists and geophysicists, progress in the developments in geophysics and geochemistry, petroleum engineering, aerial photography, new and improved techniques, world exploration and reports on production and reserves. The publication includes a bibliography of about 3,500 listings.

Midwinter construction of 20" pipe line in Illinois.

ASSOCIATED CONTRACTORS & ENGINEERS, INC.

A. L. Forbes, Jr. Earl Allen

P. O. BOX 2163 HOUSTON, TEXAS

Tennessee Gas Transmission to Start Third Line in 1949

CONSTRUCTION of Tennessee Gas Transmission Co.'s third line will be carried on in 1949 and 1950 for a project to consist of 992 miles of loops between Station Zero, near Agua Dulce, Tex., and Cornwell (Broadrun), W. Va. This third line will include 760 miles of 30-in., 143 miles of 26-in., and 89 miles of 24-in. In connection with the third line, five new stations will be built with a total of 50,000 hp.; in addition 125,200-hp. facilities will be installed in 1949-50 at previously existing stations.

With the completion of the third line, the capacity of the system will be raised to 1,000,000,000 cu. ft. daily, part of which will be available for later extensions to Buffalo and Pittsburgh.

For the Buffalo extension it is expected that Federal Power Commission approval will soon permit definite planning for construction in 1949-50 for a 395-mile line which may be built with 26-in. pipe from station No. 207 north of Ashland in northeast Kentucky, across Ohio and Pennsylvania to a connection with distributing systems now serving Buffalo. A lateral from Columbiana County, Ohio, will extend to a point in Allegheny County, Pennsylvania, to connect with Pittsburgh gas systems; thus lateral of 44 miles of 16-in. is also part of the 1949-50 program.

After the programs for building the lines to Buffalo and Pittsburgh have been approved T.G.T. will apply to Federal Power Commission for authorization to lay a line across New York state and New England. If this project is approved by FPC it will be built so as to deliver gas in New England in 1952. The 200 miles at the west end, originally planned to have 24-in. diameter may have diameter increased to 26 in. It has been expected that the 140 miles at the east end, terminating in the environs of Boston, would have 20-in. pipe.

This 340-mile Buffalo-Boston extension would be laid across New York State in the vicinity of the New York Central Railroad route through Mohawk Valley and across the Berkshire Hills.

Initial Requirements

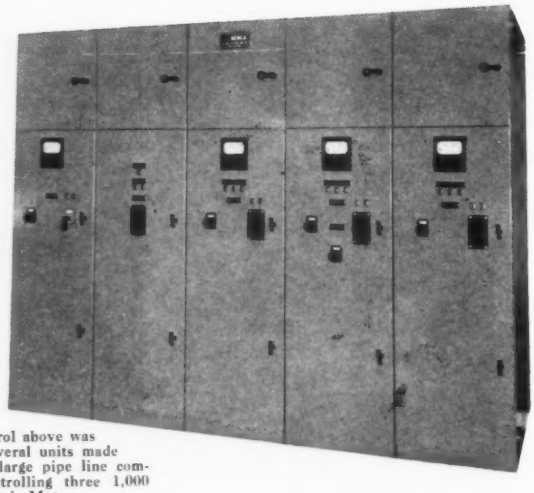
It is estimated that initial requirements for the New England line will call for delivering 100,000,000 cu. ft. daily while later it is anticipated that as much as 300,000,000 cu. ft. will be required after the New England gas companies have revamped their manufactured gas programs so as to utilize larger amounts of natural gas. Negotiations are now in progress with New England gas companies.

In 3 years of expansion activity T.G.T. has nearly tripled its investment. The steady progress of the company in looping and in adding compressor facilities is indicated by the total investment at the end of each year. The cost of the original line in 1944 plus cost of expansion to the end of 1945 was $64,168,000. At the end of 1946, investment was $77,808,000; at the end of 1947, $118,266,000; and at the end of 1948 it has been estimated it would be $180,463,996, including cost of the second line of looping.

The third line also including the Pittsburgh and Buffalo extensions has been estimated to cost $124,354,000. The Buffalo-Boston line will probably cost more than $125,000,000.

By the end of 1952 all of these programs together would total approximately $498,800,000. The fast rate of growth has induced the prediction that Gardiner Symonds, president of Tennessee Gas Transmission Co., will soon be considering a fourth line. But this is still unconfirmed.

Explosion proof
MOTOR CONTROL
for pipe line stations



The Control above was one of several units made up for a large pipe line company, controlling three 1,000 H.P. Electric Motors

Features

- Explosion Proof, designed for installation in Class 1, Group D., Division 2, hazardous locations.
- Provides short circuit, single phase, overload, undervoltage, bearing temperature and oil pressure motor protection.
- Safe—Metal enclosed.
- Shipped as complete unit, reducing time of installation and field labor to a minimum.
- Quick replacement of breakers by using semi-drawout.

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Switchboards
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ANYWHERE, ANYTIME!

DEATON AND SONS

ODESSA, TEXAS

Pipeline Construction

PHONE 6449

BOX 2928

Tapline

(Continued from page 203)

up, the lines were strung, and the machines were given their first workouts. The Skyhook differs from other cableway systems in that the carrier is self-propelled. Three machines were installed at Ras el Misha'ab. They are Model 15 SH4s powered by Chrysler engines. Several of the riggers who made the installation instructed new men in the operation of the machines. For days they ran back and forth with test loads of pipe, raising them, lowering them, and traveling with them. At the outset two cars were used simultaneously, later three. Since it is a one-way road, the cars must travel in tandem to the sea island, pick up their loads in turn, then reverse their motors and head back. Each has a capacity of 10 tons.

After a little practice, three operators were able to make a 6-mile round trip, allowing time to load and unload, in 20 minutes, moving as much as a thousand tons of pipe a day.

First Pipe Arrives

The first load of pipe reached Ras el Misha'ab just before Christmas aboard the Liberty ship William Tilghman, which had left Long Beach, Calif., some 40 days earlier. The joints were about 31 ft. in length, with ¼-in. walls, 30 and 31 in. in diameter, nested to conserve space (later shipments included pipe 5/16 and ⅜ in. in thickness), fabricated at the Maywood, Calif., plant of Consolidated Steel from Geneva, Utah, plates. The pipe plant was ready to receive it. Fed from the stockpile to ramps, the pipe was first denested by special jigs, then fed to automatic welding machines. There were four of these machines, designed by Bechtel and built by Westinghouse, which welded the joints into 93-ft. sections. When the plant was in full operation each of its automatic machines made as many as six welds per hour, turning out thirty-six 93-ft. pipe sections (72 welds) in two 10-hour shifts. Thus, welding time on the line was cut down enormously and the margin of human error reduced in proportion.

Roads and Airfields

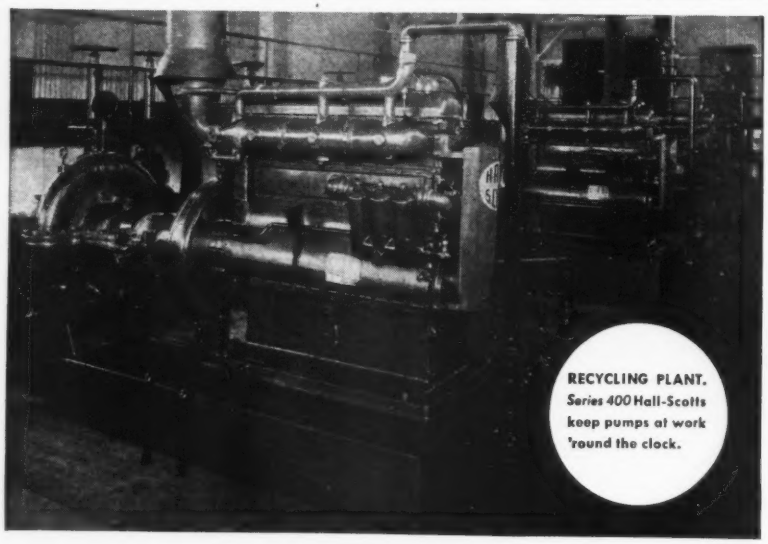
During the early days of the base camp, high-priority operations included the clearing of an airfield so that a daily shuttle service could be carried on by C-47 planes between Ras el Misha'ab and Dhahran—the main Aramco base in Arabia—carrying emergency freight and passengers. Landing strips were prepared later at other camp sites.

Another high-priority operation was the building of access roads. The first of these was to El Jauf. Over this road two or three 2,500-gal. tank trailers traveled continuously to keep the camp supplied. As the population grew, the daily consumption of fresh water rose to 60,000 gal. The water was only nominally fresh; it contained enough salts of various kinds to clog the plumbing but have a reverse effect on the men who drank it. This difficulty was largely overcome when a Cleaver-Brooks seawater distillation unit was set up. It furnished an ample quantity of pure water for drinking, cooking, and washing, but the El Jauf tank-truck run had to be maintained to meet other needs.

Late in November a trail was blazed across the desert to a location on the main pipe-line route 80 miles northwest of Abqaiq, and the first line camp was established. During this period a survey party sent out by Compania Bartlett, S.A., was rapidly nearing a junction with another Tapline party working across from the Mediterranean; and in January a tiein was made about 90 miles southeast of Duwaid, the halfway point, so that there was now a right-of-way marked out all the way from Abqaiq to Sidon, just south of Beirut, on the Mediterranean, a distance of a little over a thousand miles.

Dual-Purpose Line

On January 25 the field force was advised that the owner had decided to reroute the initial stage of the line



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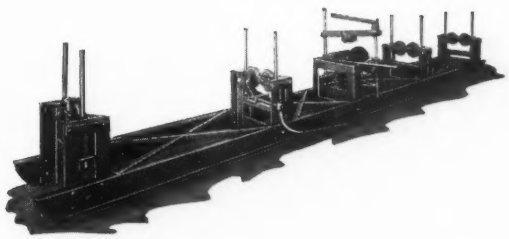
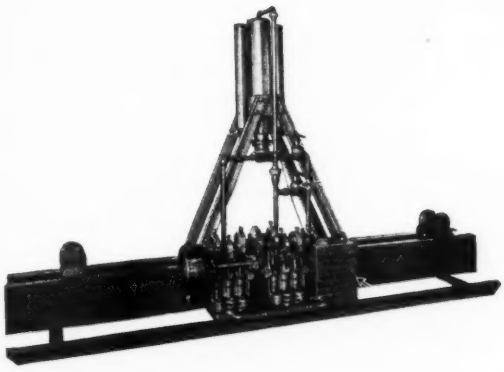


and

DUO HYDRAULIC
PIPE
STRAIGHTENERS



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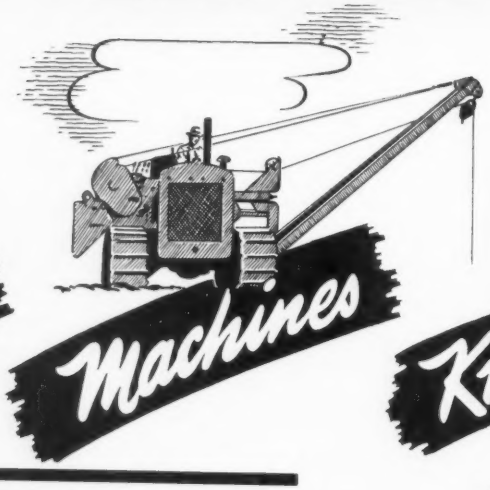

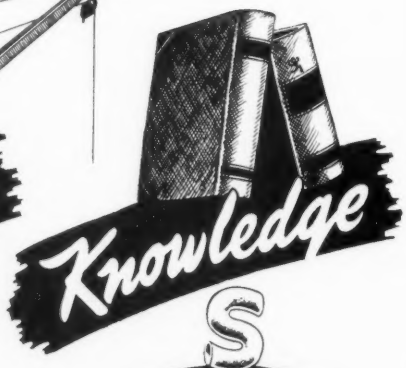

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so that it could draw oil from other nearby fields as well as Abqaiq and deliver it temporarily to Ras Tanura for refining and loading aboard tankers; in this way the line would become productive immediately, but of course it would eventually continue to the Mediterranean as originally planned.

Accordingly, additional surveys were made from Abqaiq to Qatif, from Qatif to Abu Hadriya, and from Abu Hadriya to Hafer el Batin—the latter being about 300 miles northwest of Abqaiq.

A new line camp was established at Qatif. Right-of-way had already been cleared between Qatif and the Ras Tanura refinery, 17 miles distant on the Persian Gulf, to which Bechtel was laying for Aramco a 20 and 22-in. line. This was now adjusted to be tied in with the first portion of the trans-Arabian line, which would run 44 miles from Abqaiq. It became mandatory to have the combination of the two completed and in operation by the beginning of May. There was a pressing need for additional outlets for the oil of Abqaiq.

Construction Problems

The Abqaiq-Qatif line would be 30 in. in diameter, and 24 of its 44 miles were to be above ground, the remainder being buried. Due to the impracticability of building underground pipe line across sabkha, 12 miles of the above ground section were allotted to sabkha areas, while 12 additional above-ground miles were allotted to areas of known rocky structure.

A sabkha is a saline flat below the water table or in an undrained pocket in the Arabian desert, from 4 to 20 ft. in depth and generally saturated with water, commonly but not necessarily occurring within a few miles of the sea. It is, or could be, a lake which has been choked by drifting sand and dust. During prolonged dry periods the surface may harden sufficiently to carry construction equipment (every now and then a truck or tractor breaks through), but it will not support heavy, concentrated loads. Therefore, where the 30-in. pipe line was to cross such areas piling had to be driven to the firm formations underneath.

For the above-ground sections over rock, the line was restrained by ring girders and supported on small concrete pads. Excavating in this rock, which was tough marine limestone, would have been very expensive—a fact that was conclusively proved in some rocky sections where trenching was undertaken.

Some miles of the above-ground right-of-way passed through or near massive sand dunes rising to varying heights up to 50 or 60 ft. from the desert floor. Observations made during the past few years showed that the dunes were moving in a southeasterly direction at rates of anywhere from 10 to 50 ft. a year, depending on the size of the dunes and somewhat on the locality. Consequently, where these dunes could not be avoided the line was laid under them so that in future years it would not become exposed and left hanging in the air. This operation necessitated the moving of large quantities of sand by bulldozers and scrapers.

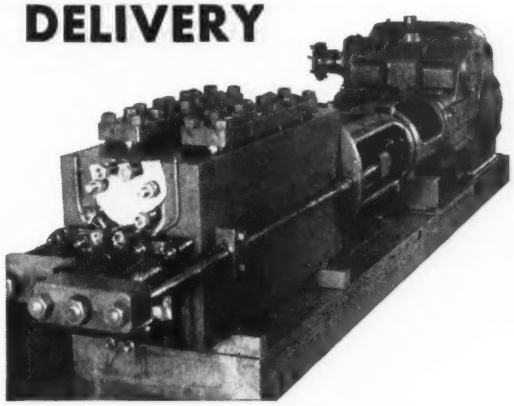
Underground portions of the line were constructed with standard pipeline equipment for over-the-trench cleaning, priming, and coating, and standard big-inch pipe-line procedures were employed throughout.

For the above-ground sections standard methods and equipment were used, except that the line was restrained and expansion joints were eliminated. Thus, the final tying together of various-length sections between anchors and/or deflection points was rigidly controlled to assure as nearly as practical a uniform temperature of 90° at the time of each union. This temperature was chosen because it was assumed to be the mean between the minimum and maximum that would occur in actual operation.

Right-of-way clearing through sand hills and dunes was done with draglines, bulldozers, and scrapers, while for the 20 underground miles 6-ft. trenches were excavated by a number of devices, varying with the terrain: ditching machines, back hoes, a 20-

. . . for

IMMEDIATE DELIVERY



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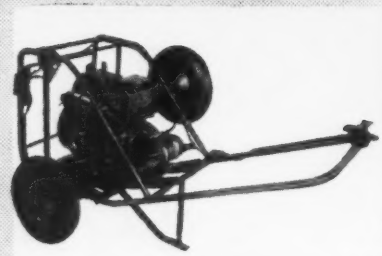
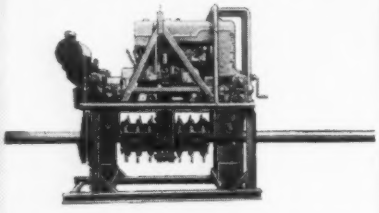
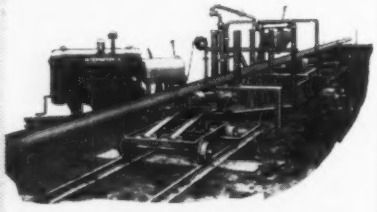


1500 WATT SELF PROPELLED GENERATOR — utility unit for operating small hand tools such as sanders, wire brushes and for cleaning bevels.

EXPANDER — sizes 10" to 30". Puts pipe in perfect circle so that true bevels may be cut. On a 20 mile 16" reconditioning project, this tool saved the company 4,000 feet of pipe.



MODEL M CLEANING MACHINE — on stationary base. Will clean and prime all pipe sizes from 2" to 14".



STATIONARY COATING AND WRAPPING MACHINE — pipe sizes 2" to 30". Will apply any specification — that is single coat and wrap, single coat and double wrap or double coat and double wrap.

HOLLIDAY DETECTOR — the detector with voltage control and voltage measuring device.

Model illustrated is Trac-Type mounted — Tracs are easily removable in order that unit may be mounted on truck if desired

LITTLEFORD PIPE LINE KETTLE

Crose's long experience with pipe line coating equipment and Littleford Bros. long experience in manufacturing all types of heating equipment made it possible to develop a practical pipe line kettle.

This kettle has only one burner furnishing the heat—lights instantly — no preheating — no electrical ignition—burns diesel fuel or kerosene from 2 qts. to 15 gal. per hour — burner is low pressure type assuring even distribution of heat which prevents warping or burning out bottoms — made with Trac-Type wheels or Skids for truck mounting.

Agitator is hydraulically operated and designed to keep all filler in suspension with a reciprocating motion. Agitator assembly is protected from overload by relief valves. The system is fully automatic and needs no operator's attention, except to start or stop its motion at will.

OTHER QUALITY PRODUCTS SOLD BY CROSE

Rolling Rigs • Burners • Wire Rope • Road Boring Machines • Patching Kettles
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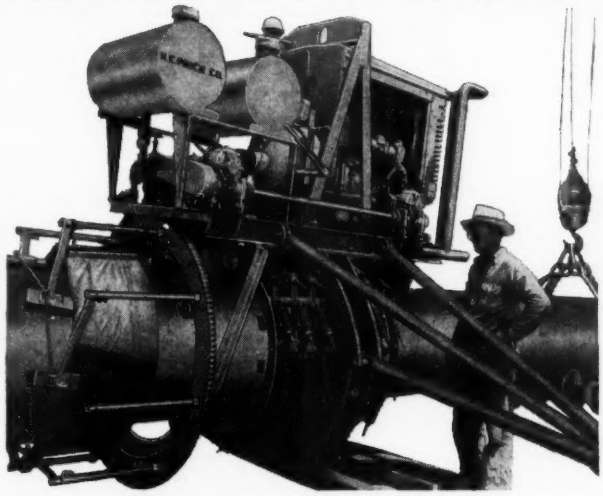
CROSE MODEL K CLEANING AND PRIMING MACHINE IN OPERATION ON THE "BIGGEST INCH"



The Crose cleaning and priming machine is shown in operation on a 30-31" natural gas pipe line project in South Texas.

Crose designs and builds pipe cleaning and priming equipment for all sizes of pipe. All Crose pipe cleaning machines have these major characteristics: 1. Rubber crawler wheels—which gives positive traction without scoring or marking the pipe. 2. Interchangeable roller ring assemblies—give maximum surface speed on the pipe surface to be cleaned. 3. Separate transmission for priming attachment—allows complete control of priming head. 4. Machine operates equally well when used as traveling type machine or on a stationary base.

We will be glad to work with you on any pipe cleaning problem you may have.

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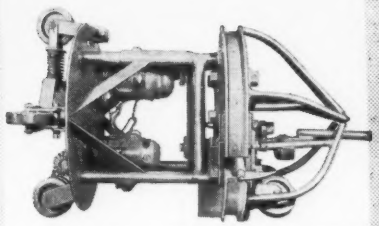
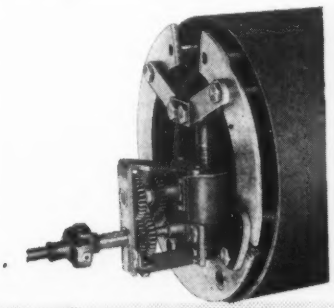
3. Vitron Glass Fiber, 400 or 800 foot rolls—3, 6, 9, 12 and 18 inch widths.

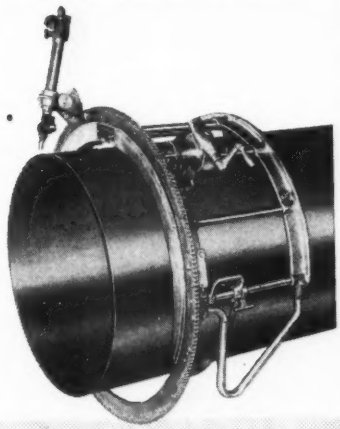
All material available for immediate shipment from warehouse stocks at Tulsa, Oklahoma.



ELECTRIC MODEL INTERNAL LINE-UP CLAMP — the clamp with the power for fast true line ups on "Big Inch."



MANUAL INTERNAL LINE-UP CLAMP - NEW - IMPROVED MODEL — The clamp with a transmission—High gears for rapid expansion and contraction—Low gear for power in rounding out "egged" or dented pipe. Sizes 12" to 31".



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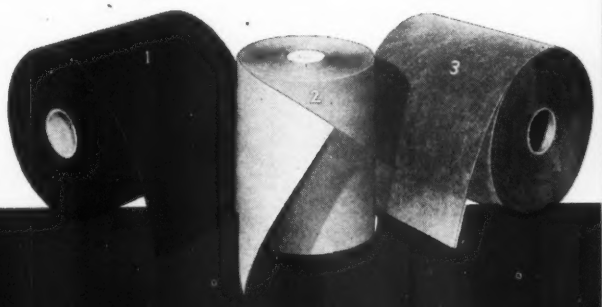

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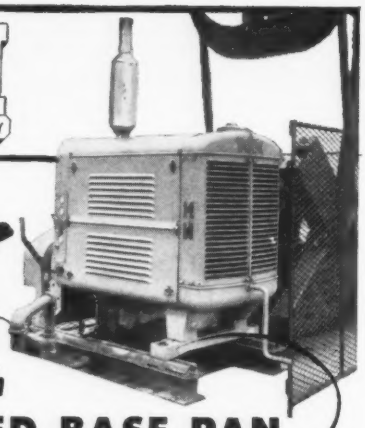

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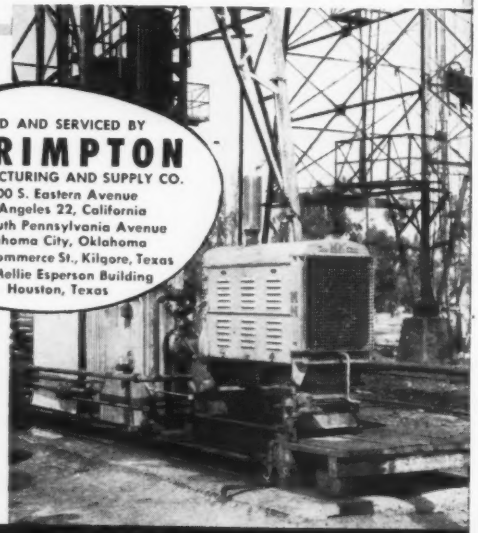

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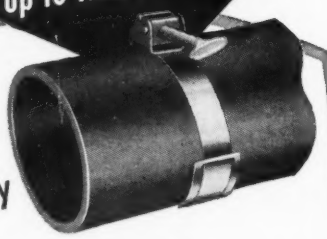

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ton giant ripper (pulled by as many as six D8 tractors), dynamite, and hand shovels.

The first convoy of pipe reached Qatif from Ras el Misha'ab on February 16. Kenworth 6 by 4 and 6 by 6 trucks equipped with low-pressure sand tires pulled trailers carrying nine sections of pipe apiece, weighing nearly 40 tons. The distance of some 160 miles was thereafter covered without serious trouble, although occasionally one of the trucks crossing a sabkha would break through the crust. Round trips were often made in 24 hours, including unloading time. The stringing was done with two D8 sidebooms in unison unloading each trailer, a sling being fastened to either end of a 93-ft. pipe section. Lining up and tack welding were carried on with the aid of a Price electrically driven automatic internal line-up clamp. The pipe liners forged ahead day after day despite unexpected rains, sandstorms, persistent flies, and ever-increasing heat as the season wore on. Wind screens were often set up for the protection of welders, but during severe shemals they were forced to stop work when sand blew under their masks and blinded them.

Gamma Ray and Corrosion Protection

A high standard of welding was maintained in the field by rigid inspection and the systematic taking of gamma-ray photographs. Corrosion protection was studied at the same time, and the findings were invaluable. For instance, the soil resistivity of subkhas is approximately that of sea water, averaging 30 to 40 ohms per cubic centimeter, and the soil is highly corrosive. In such areas the pipe was kept above ground, of course, and needed protection from soil corrosion only when covered with drifting sand—which was corrosive too. The pipe was coated and wrapped wherever it lay in the path of a dune. Inasmuch as coating left uncovered would deteriorate rapidly in the sun, the coating and wrapping operation was deliberately held in abeyance until the sand began to touch it. The entire above-ground structure was cathodically protected by magnesium anodes. In all buried sections, where the pipe was coated and wrapped, very little current was required; a single installation of two to five anodes would protect several miles.

First Stage Completed

The pipe liners moved steadily southward from Qatif, and before the end of April they had completed 37 miles to a trapsetting just built by Bechtel for Aramco, and, after hydrostatic tests, oil began flowing through the line. Early in May the remaining distance to the Abqaiq No. 1 pumping station, 7 miles, was tied in. Since then there has been a steady flow of about 120,000 bbl. a day through this 44-mile 30-in. line, being carried pro tem from Qatif to Ras Tanura (17 miles) by the Bechtel-built 20 and 22-in. Aramco line.

The construction of the Abqaiq-Qatif section of the line introduced new methods of restrained construction hitherto untried in Arabia with large-diameter pipe; it was carried out in varied terrain presenting most of the major difficulties to be expected along more than half the 1,067-mile route to the Mediterranean; so it will have served as a pilot line and a model, thus facilitating the remainder of the job.

The pipe liners' next move was to Abu Hadriya, a field now ready for development. Here they established a camp and began laying pipe toward the Qatif junction, 80 miles to the southeast. With the tying in of Abqaiq, Qatif, and Abu Hadriya fields, there will be an immediate outlet for all three of them through the refinery and port at Ras Tanura. With the program continuing as planned, pipe will be laid northwestward 30 miles from Abu Hadriya to the site of pump station No. 2, and beyond, until the present supply is exhausted. It is noteworthy that if the 208,000 tons of pipe steel needed to complete the line were put into tanker construction, only 40 tankers

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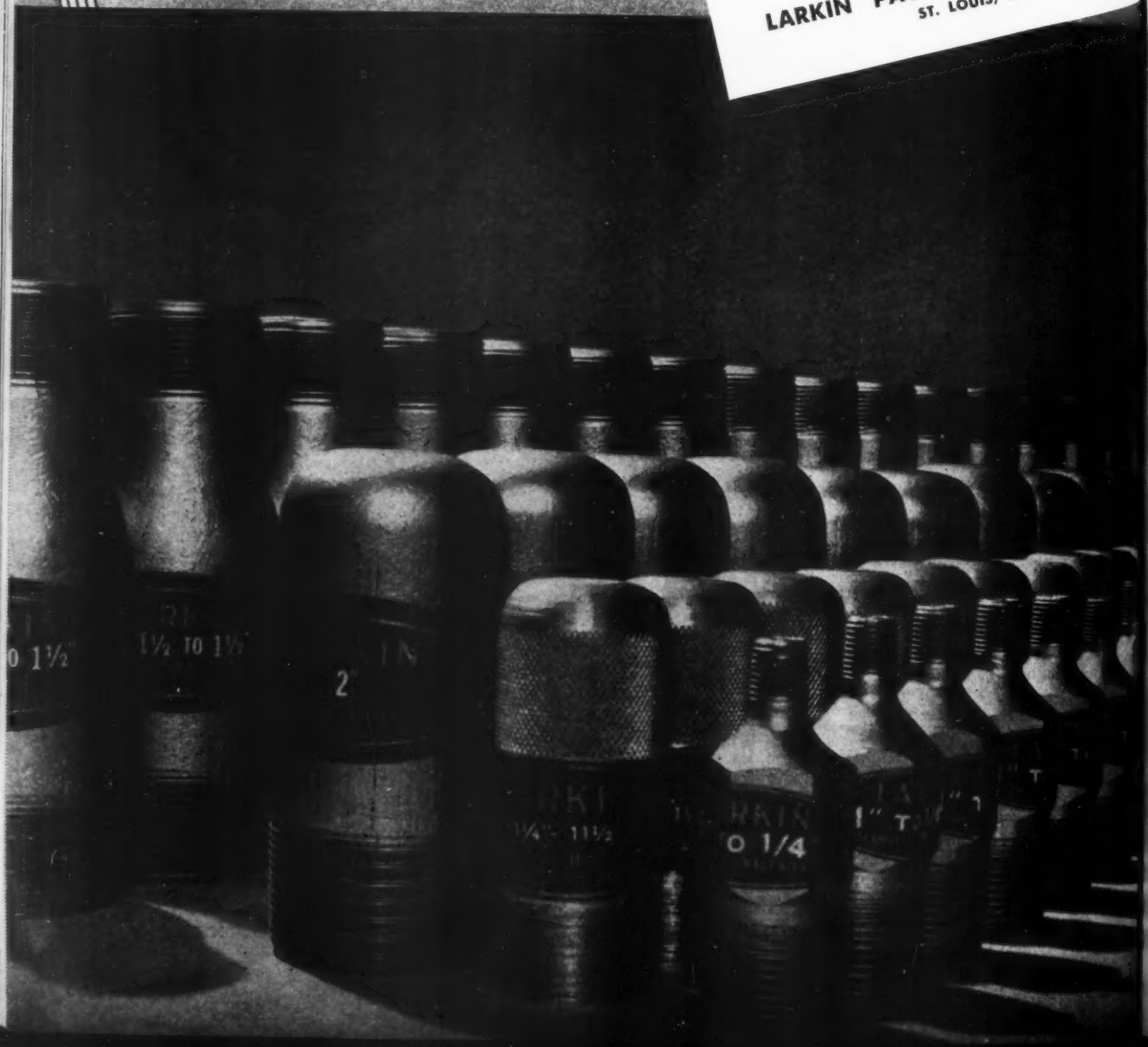

could be produced; and the oil they could transfer from the Persian Gulf to the Mediterranean would amount to only about 200,000 bbl. per day as compared with the pipe line's capacity of over 300,000.

Personnel

The number of Americans employed by Bechtel in the field for this first year's phase of Tapline averaged about 500, and despite the remoteness and loneliness of the location and the rigors of the climate many of the original recruits are still on the job, determined to fulfill their 18-month contracts. Except in the very early stages of the project before supplies and equipment had begun to arrive in quantity, the American workers have been well housed and well fed. There has never been on hand less than a 30-day supply of refrigerated foods, in case of unforeseen shipping delays, and this has necessitated the construction of large refrigerated storage chambers. Beer is served to American workers in the recreation halls and movies are regularly shown. Both Arabs and Americans receive free medical attention. Two of the scourges of the Arabian desert—heat and flies—have been minimized by the installation of air-conditioning units in mess halls and living quarters, and the liberal spraying of DDT around the camps, both indoors and out.

Some 1,500 Arabs have been regularly employed through local subcontractors, living in tent camps especially set up for them. Some of these Arabs, both townsmen and Bedouins, were semiskilled workers who had had construction experience around Dhahran or on Behrein Island; many have been developing new skills while employed by Bechtel. Besides common laborers, there are houseboys and mess-hall attendants, truck drivers, tractor operators, electricians, tugboat skippers and engineers, mechanics, carpenters, jackhammer men, welders, and welders' helpers. There are also Arab interpreters and clerks.

Americans working among Saudi Arabs have to adjust themselves to differences in language and religion. Arabic is a difficult tongue which few foreigners ever master, but many American construction men pick up in a few months a hundred or more words and phrases which serve them remarkably well; and the Arabs around them are learning a good deal of English. Al Saudi Arabs are devout Moslems, and pray five times every day. Americans have to get used to seeing their Arab coworkers walk quietly away, one at a time or collectively, turn in the direction of Mecca and prostrate themselves for as long as a quarter of an hour. The Moslem holy day is our Friday, and accordingly Americans in Arabia have come to observe their Sunday on that day, too.

Associates of International Bechtel, Inc., contractors for the easterly two-thirds of the Trans-Arabian line, comprise: Bechtel Interests, San Francisco; R. A. Conyes, Oakland, Calif.; Morrison-Knudsen International Co., Inc., Panama, R. de P.; Pomeroy Interests, San Francisco; H. C. Price, Bartlesville, Okla.; Sverdrup & Parcel, St. Louis.

Credit for the conception and overall planning belongs to President B. E. Hull of Trans-Arabian Pipe Line Co. and his colleagues, notably Vice President H. H. Hall and Vice President E. A. Skinner; and Engineers Harry Britton, Jack Culbertson, W. R. Chandler, A. E. Olson and P. P. Nibley. In the field, Tapline is headed by H. H. Hall, with Oscar Burden as general manager and W. R. Chandler as assistant general manager. In immediate charge of construction of the 44-mile Abqaiq-Qatif portion of the line was Ray L. Hamilton, loaned to Tapline by Bechtel during the absence of D. T. Pinckney, who was on home leave and has since returned to Arabia. George S. Colley, Jr., a vice president of International Bechtel, took charge as project manager for the constructors in the fall of 1947. Subsequently his staff included Al Berlander, construction manager; Don Roberts and Harry Waste, project engineers; R. L. Bowman, pipe-line superintendent, and Al Poggi, transportation superintendent.

On Top
IN OUR FIELD

Nueces, San Patricio and Karnes Counties—all in South Texas—produced approximately 2,707,630 barrels of crude in July, 1948.

Of this volume these companies produced, purchased and pipelined 1,222,604 barrels, or almost 45 per cent of the total.

It was gathered, transported, terminaled and marketed through our own facilities, a fact which demonstrates our leadership in the fields where we operate.

★

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Semiautomatic Controls

(Continued from page 206)

is true of the rate-of-flow controller whenever the set rate of flow is reached. Of the three instruments mentioned any one can "override" the other two at the proper time; thus only one of the three is controlling at once.

As an additional safeguard an under-pressure alarm is installed on the station intake and an over-pressure shutdown is installed on the station discharge. Since no harm can be caused by the variable-stroke pump going to zero stroke or by the constant-stroke pump running out of sufficient liquid for a short period of time, an alarm was chosen in place of shutting down.

At present only one constant-stroke pump is installed and as No. 3 unit. As greater pumping capacity is required additional constant-stroke pumps will be installed. They will be arranged to come on the line in sequence such as No. 3, then No. 4, then No. 5 and No. 6. By means of a selectro switch this sequence can be changed to any circular combination such as 5-6-3-4. This change in sequence is desirable in order not to have the same constant-stroke pump always start up first thus causing more wear on this particular constant-stroke pump. In addition, when a constant-stroke unit is down for repairs, or other reason, this unit will be skipped in the sequence.

The following methods of operation are in use:

1. McKee station receiving from Rocky station. Rate-of-flow controller is set higher than any rate possible and is therefore inoperative. Suction or discharge instruments control as necessary.

2. McKee station receiving from Shamrock refinery. Rate-of-flow controller is set at desired flow rate and suction or discharge controllers take over as required.

3. Whenever the rate is greater than 3,100 bbl. per day, or the capacity of one unit, the constant-stroke pump and one or two variable-stroke pumps are operated. When the rate is below 3,100 bbl. per day the constant-stroke unit of course cannot be operated. When the desired rate is 3,100 bbl. per day or the capacity of one unit only the constant-stroke pump is used when receiving from Shamrock but it is necessary to use a variable-stroke pump when receiving from Rocky to keep in step with the flow from Rocky.

Station operators are required at McKee for other duties as well as giving some attention to the semiautomatic station. At La Junta the station is located close to where terminal operations are being carried on and no full-time operators will be required. La Junta station will

THE AUTHORS

G. P. Jennings is chief engineer of the products pipe-line department of Phillips Petroleum Co. A native of New York State, he obtained his M. E. degree at Rensselaer Polytechnic Institute in 1923. He served Worthington Pump & Machinery Corp. for 3 years as service engineer, and for 2 years was in the zinc industry as design engineer. He joined Phillips in 1930 and was appointed to his present position in 1942.

G. P. JENNINGS

D. A. ROACH

D. A. Roach is an engineer in Phillips' product pipe-line department. A graduate of University of Nebraska with a B.S. degree in civil engineering, he served 4½ years in the Corps of Engineers in World War II, and was discharged with rank of major. He joined Phillips in 1946.

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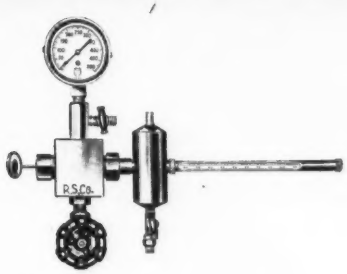

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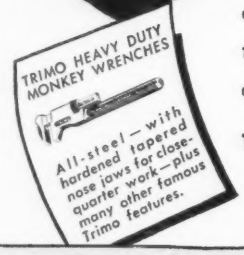
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pump to Denver when the line is completed to that point, and will be almost an exact duplicate of McKee station.

Metering and other equipment on the intake of the McKee station is designed for 300 lb. operating pressure. The McKee station controls previously described should keep the pressure safely below this point but if for any reason the pressure should tend to rise above this safe operating intake pressure, an intake-line pressure controller set to operate at 295 lb. is placed at the McKee station preceding the 300-lb. equipment. The pressure controller then holds the intake pressure on the McKee station to not over 295 lb. while the upstream side may build up pressure on the Rocky station. No damage will result even though the flow is completely stopped, since when this condition exists the variable-stroke pump at the Rocky station will reach its maximum set pressure and go to zero stroke.

Welded Aluminum Alloy Pipe Lines

(Continued from page 211)

For position, or "bell hole" welds, the time is about 50 per cent greater. Welding technique is still being improved, and it is believed that the speed of welding aluminum pipe will equal that for steel.

The quality of welds made by this method is good. There is no weld spatter nor evolution of smoke and fumes. Both interior and exterior surfaces are smooth, and an experienced welder has no difficulty in obtaining welds free from cracks or porosity. In one case, approximately 200 welds in 4 and 6-in. pipe were made and tested under a water pressure of 1,000 psi. All welds proved tight with no sign of leaks, sweating, or overstressing. No repair welding of joints was required.

The strength of circumferential welds in aluminum pipe has been the subject of intensive study. The welding operation tends to anneal the heat-treated aluminum alloys in a narrow band adjacent to the weld reducing the tensile efficiency of joints. However, the bursting efficiency is higher than that in tension because of the reinforcing action of adjacent metal which has not been annealed. In general, the bursting strength, as figured by Barlow's formula, is about 80 per cent of that of unwelded pipe based on minimum guaranteed tensile strength. Table 3 gives bursting strength for various sizes of aluminum pipe as determined by actual tests. It will be noted that the strength for 61S-T6 is somewhat superior to that of 63S-T6. For pipe from 6 in. down 63S-T6 affords ample strength for pressures ordinarily encountered in pipe-line work. For larger diameters alloy 61S-T6 is more economical even though its price per pound is slightly higher.

In laying aluminum pipe definite advantages arise from the light weight, and the smooth exterior. A 40-ft. length of standard 4-in. IPS aluminum pipe weighs only 149 lb.; the weight of the same length of 6-in. pipe is 262 lb., and for 8-in. pipe with a 0.277-in. wall a 35-ft. length weighs 299 lb. It is obvious that such pipe can be handled more easily and rapidly than the customary steel pipe, and substantial savings in manpower, equipment, and time are effected. Of further interest is the fact that standard aluminum pipe down to 1-in. size will float with the ends plugged. Due to the combination of light weight and smooth surface, aluminum pipe can be pulled in long strings without difficulty. In one case, over 2,300 ft. of 4-in. pipe was pulled with all the welding being done at one location. This string of pipe was rotated as each joint was made to speed up the welding operation. This factor is of considerable importance where pipe lines are being laid in marshy country.

Resistance to Corrosion of Aluminum Alloys

Resistance to corrosion, both external and internal, is of primary importance in determining the economics

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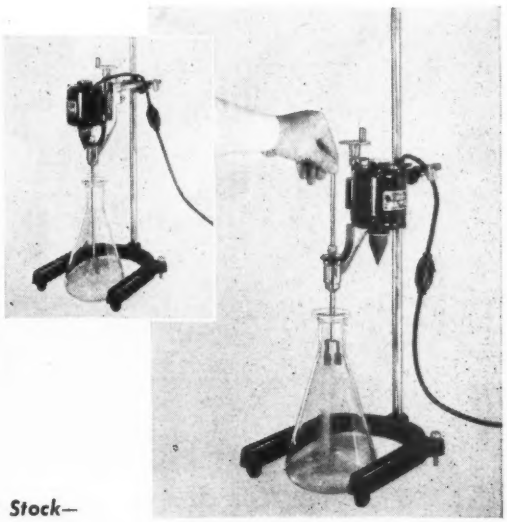
New Model, Now Avaliable from Stock—



In redesigning the Sargent Cone Drive Stirring Motor, the basic form, size and characteristics, including the method of transmitting power by means of a driving cone and a driven ring have been retained because of definite advantages they have displayed over other types of stirring apparatus during many years of proven performance in the field. However, now, certain mechanical inconveniences in manipulation which formerly existed, have been eliminated and the efficiency and ease of operation greatly increased.

NEW MOTOR MOUNT—The motor is mounted on a threaded rod and urges the driving cone against the friction ring by means of a pressure plate with adjustable spring tension. This type of mounting permits the motor to be swung away and held in a free positin without changing the lateral position of the chuck. For additional convenience, the motor may be swung to either side of the friction ring, from where it will operate with equal efficiency.

FULL POWER AT ALL SPEEDS—The patented Sargent cone-to-ring device in which the driving cone and the driven ring rotate in the same plane, reduces cross-drag to a negligible quantity and delivers full power to the chuck at all speeds from 75 to 1300 r.p.m.

CHUCK HELD IN FIXED POSITION—The speed is varied by turning a hand wheel which raises or lowers the motor and alters the position of the cone with relation to the friction ring. In this type of design the ring and chuck are held in a fixed position and all lateral movement is in the cone and motor.

FEED-THROUGH SPLIT-COLLET CHUCK—Another feature of the new model Sargent Cone Drive Stirring Motor is the feed-through split-collet chuck which permits the stirring rod to be removed from the vessel in which material is being stirred, without repositioning the motor on the support rod. To accomplish this, merely swing the motor to one side, loosen the chuck and raise the stirring rod out of the vessel through the open top of the chuck.

S-76445 STIRRING MOTOR, Electric, Sargent Cone Drive, Variable Speed, Patent No. 1,973,576. For operation from 115 volt 50/60 cycle A.C. circuits.....**$45.00**

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of aluminum pipe lines. It is known that the resistance to corrosion of the magnesium-silicide type of aluminum alloys is superior to that of steel under a wide variety of conditions. Indications are that the exterior surface of aluminum pipe will not require coating in well-drained soils of normal composition. In marshy locations where there may be organic matter in the soil, and in salt marshes, protective coatings will probably be required. In moist alkaline soils, aluminum will be attacked and particularly careful external protection would be required. Both laboratory and service tests of aluminum pipe are being conducted to give further information on resistance to corrosion. The use of galvanic anodes to protect aluminum pipe is being studied, but this work has not progressed to the point where definite recommendations can be made.

In laying aluminum lines, precautions must be taken to prevent direct connections between steel and aluminum. At such joints insulating flanges are used and the sections of pipe should be wrapped for some distance on each side of the joint. If aluminum and steel, or more particularly aluminum and copper, are in contact in a moist soil, current will tend to flow through the soil from the aluminum to the other metal protecting the latter but causing corrosion of the aluminum.

The experimental work and limited service experience available indicates that aluminum will withstand the corrosive action of sour crude and sour gas to a marked extent. Laboratory tests have indicated that aluminum is far more resistant to hydrogen sulfide gas, and to brines, than is steel. It is recognized that the liquids carried in pipe lines may vary tremendously in composition, and that many elements and compounds other than hydrogen sulfide and brine may be present. Corrosive combinations may be encountered which will prove destructive to aluminum pipe, but it is certain that aluminum is highly resistant to the most common agents of corrosion found in crude oil and it is believed that the life of aluminum pipe lines will far exceed that of steel in sour-crude service.

Cost of Aluminum Pipe Lines

A discussion of costs is rather difficult under present conditions of fluctuating prices for material and labor. The base price of aluminum pipe in standard sizes, as shown in Table 3, is about twice as much per mile as steel. This comparison is based on mill prices and does not reflect the abnormally high price which is being paid in many cases for steel pipe under present conditions. The cost per mile for 63S-T6 pipe averages about the same as steel pipe at $195 a ton. For alloy 61S-T6 the comparable steel price would be about $220 a ton. One point worthy of note is that it has been customary to quote prices of aluminum pipe f.o.b. the mill with carload rate of freight allowed, so that essentially, transportation from the mill to the railroad site nearest the job is included in the quoted price for aluminum pipe.

It has been pointed out above that there are savings in the local transportation and handling of aluminum pipe due to its light weight. It is difficult to evaluate this factor in terms of cost per mile of pipe line but on certain jobs it may well prove a substantial item. The value of this factor obviously increases in remote locations where transportation is complicated by mountainous or marshy ground. The cost of ditching and backfilling may be taken as constant regardless of the type of pipe employed.

In general, the cost of welding aluminum pipe will be slightly higher than that for steel. The speed of welding is the same, but equipment costs are a little higher, and the cost of the argon gas used is a factor. Under existing conditions, the gas costs for 6-in. standard pipe will average about 55 cents per joint, and about 35 cent per joint for 4 in.

. Until further experience is gained, it should be assumed that the cost

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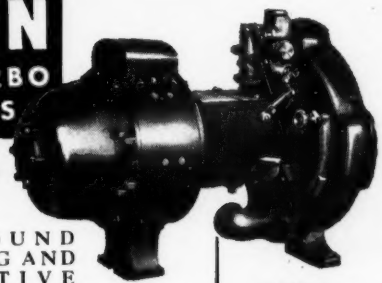

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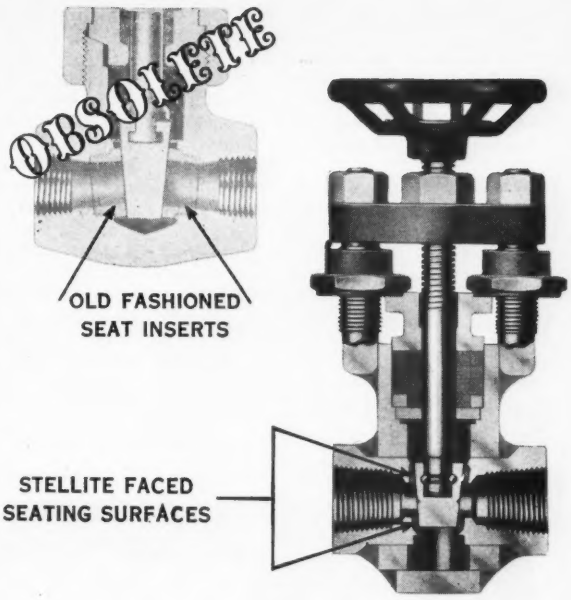

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for protection for the exterior of aluminum pipe will be the same as that for steel. In the long run, somewhat less protection will be required, but the extent of this saving cannot be estimated on the basis of present knowledge. In general, the materials and procedures used for coating and wrapping steel pipe can be applied to aluminum with equal speed and efficiency.

Taking all of these factors into account, it appears that the cost of aluminum pipe lines, completed and ready to carry oil, will be from one-third to one-half more than that of a similar steel line, basing pipe costs on mill prices. With this in mind, it is evident that aluminum pipe lines will prove a good investment for locations where the aluminum pipe will last at least twice as long as steel pipe under corrosive conditions.

The future for aluminum pipe lines lies in sour-crude service, or in soils where its resistance to corrosion will insure long life with minimum leakage. A second possibility is that of portable lines for temporary service and for military use, where light weight will effect substantial savings in time and costs for moving pipe.

Even though the current supply of aluminum pipe is very limited, moderate amounts for short test lines are available. Through cooperative test programs a background of service information is being built up which may well lead to substantial savings for pipe-line operators in locations where maintenance and corrosion losses have been excessive.

This "Packaged Unit" is the combination of two engineering greats—the Leland Oil Field Truck Body plus the Tulsa Winch. This compact unit has received a hearty welcome wherever winching operations and the use of gin poles are required. This unit is fabricated to standard truck wheelbases for easier "on-the-spot" field installation.

LELAND TRUCK BODIES

The Leland Oil Field Truck Body is equipped with tail roller fabricated from hydraulic tube, rolling on bearings supported by heavy steel castings; steel fabricated frame; 2 inch, center match hardwood deck; headache rack of heavy duty tubing and gin poles of heavy duty drill pipe.

TULSA WINCHES

Tulsa Winches are equipped with an irreversible worm and gear which are designed to hold a load while raised. As an added safety factor Tulsa Winches are also equipped with an automatic worm brake, which necessitates the load being lowered by power. Simplicity of design and few moving parts provide years of dependable, trouble-free service.

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Headers for Chicago Gas-Transmission Line

For the program of Natural Gas Pipe Line Co. of America to increase throughput from 229,000,000 cu. ft. to 376,000,000 cu. ft. daily, 400 tons of fabricated piping has ben installed in connection with new facilities to provide for increased deliveries of 147,000,000 cu. ft. daily. Piping for this project, furnished by Midwest Piping & Supply Co., has ranged from 3 to 26-in. diameter. Compressor stations where this piping has been installed include those near Hooker, Okla.; Stinnett and Perryton, Tex.; Bloom, Heizer, and Glasco, Kans.; Beatrice, Neb.; Hastings, Truro, and Harper, Iowa; and Geneseo, Ill.

Piping includes 130 welded discharge headers, 18 in. in diameter with $\frac{3}{8}$-in. wall thickness, which were given full furnace treatment to relieve stresses. Nozzle welds on headers were reinforced by welding saddles. Nozzles and butt welds were inspected by gamma ray. Furthermore, a simplified type of river-crossing header was devised for the project. This consisis of a special T-fitting with two reducing elbows which eliminate the use of end closures and reinforced nozzles formerly in river-crossing headers.

S.E.G. Publishes Index

A new cumulative index, containing listings of all geophysical data published by the organization since 1931, has been published by the Society of Exploration Geophysicists. Topics are indexed by subject, author, and volume of Geophysics, the society's journal. In addition, the cloth-bound volume carries a complete Geophysics Patent Abstract Index, which lists abstracts of all geophysical patents as carried in Geophysics since 1939. The index is available to members of the society at $2 per copy and to nonmembers at $2.50 per copy. Orders for the book should be addressed to the Society of Exploration Geophysicists, Box 1614, Tulsa.

BOOKS

STRUCTURE OF TYPICAL AMERICAN OIL FIELDS, VOL. III. Published by The American Association of Petroleum Geologists, Box 979, Tulsa. 516 pp. $4.50 to nonmembers, $3.50 to members.

Twenty-four oil and gas fields are covered in individual papers, in 13 states and Canada. Each of these fields is characterized by some distinctive and peculiar features of stratigraphy, structure, and accumulation. The fields described cover a wide variety of conditions, such as offshore, slant-hole, multiple wells from a single surface location, reservoirs hidden beneath volcanic rocks, reef accumulations, and fault traps.

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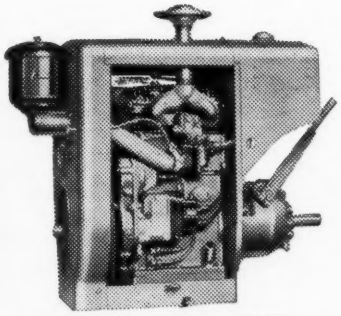
Rotary Pumping Units

Centrifugal Pump Units



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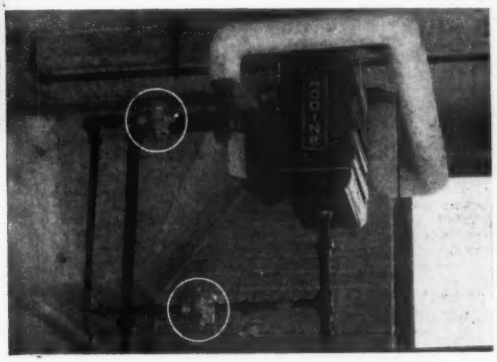

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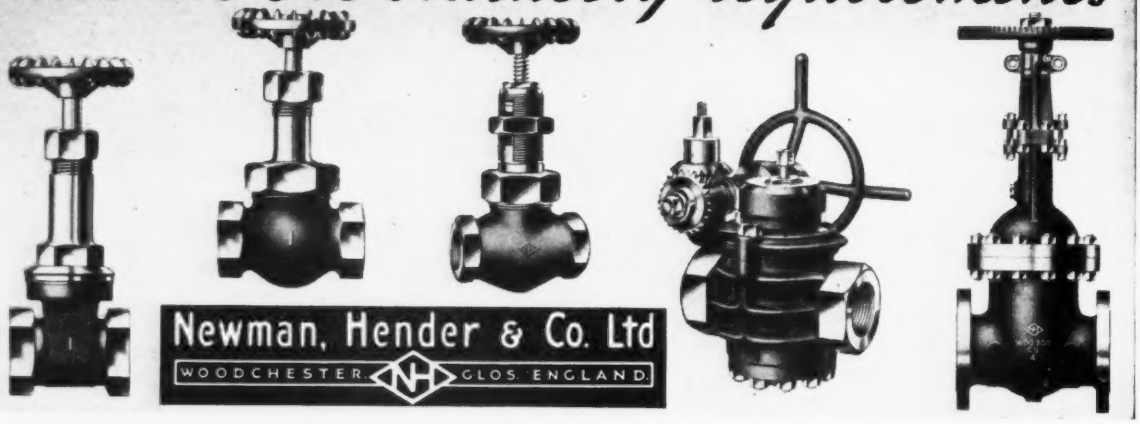

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HARPER

Instrumentation

(Continued from page 217)

should be cut out in order to permit the valve to operate within its normal working range and bypass less water. This is accomplished automatically by the Rotax controller making contact at the first of two low set points. If, after this fan is cut out conditions change so that the valve again approaches its wide-open position, a second fan should be cut out. This is accomplished when the Rotax controller reaches the second of the low set points. Neither fan should again be started until the control valve approaches a minimum opening. When this occurs the Rotax controller reaches the first of its two high set points and starts one fan. If conditions again change, tending to move the valve to a more nearly closed position, the Rotax controller reaches the second high set-point and cuts on the second fan. The entire system operates to cut in and cut out fans as necessary in order to maintain the bypass control valve always within its normal operating range.

Engine-Oil and Compressor-Jacket Temperature Control

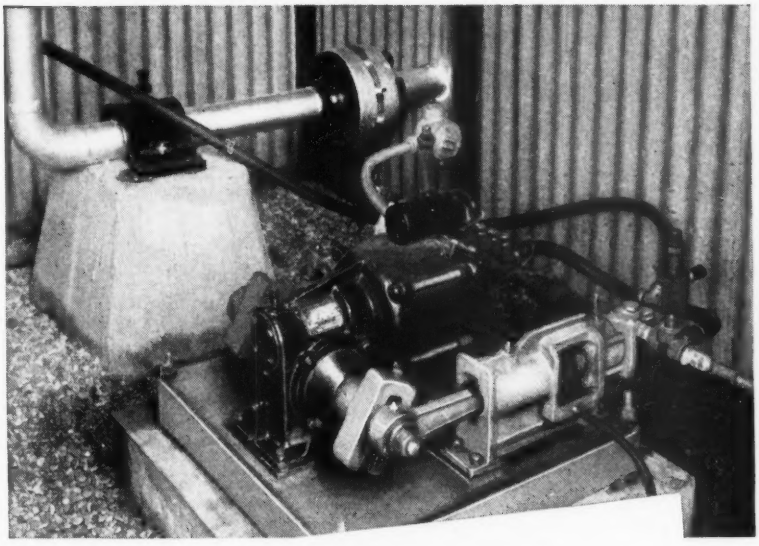
The engine-oil and compressor-jacket temperatures are likewise controlled automatically by an electronic Dynalog temperature recorder-controller. The water system is also a closed one, but differs from the engine-jacket system in that the water is cooled through a tubular cooler in the base of an induced-draft cooling tower. The water at controlled temperature passes first through a counter-current tubular exchanger, during which time it cools the engine oil, and from this exchanger it passes to the compressor jackets, thence to the cooling tower. Control is maintained by bypassing hot water to the cooled water in a manner similar to that employed by the engine jacket controller.

Experience with automatic temperature control of cooling water for internal combustion engine jackets and gas compressor cylinders has proved conclusively that maintenance costs are thereby reduced. Many mechanical difficulties formerly encountered such as piston seizures and cracked cylinders are eliminated when close control of water temperatures is maintained.

Gulf Posts Bond for Spillman's Island Test

HOUSTON. — Gulf Oil Corp. has posted a $2,500,000 bond with the Port Commission for the right to drill for oil on the Houston ship channel near Spillman's Island.

The bond is to apply to any possible damage to navigation during the drilling of the test. Drilling is to be done from a floating barge.



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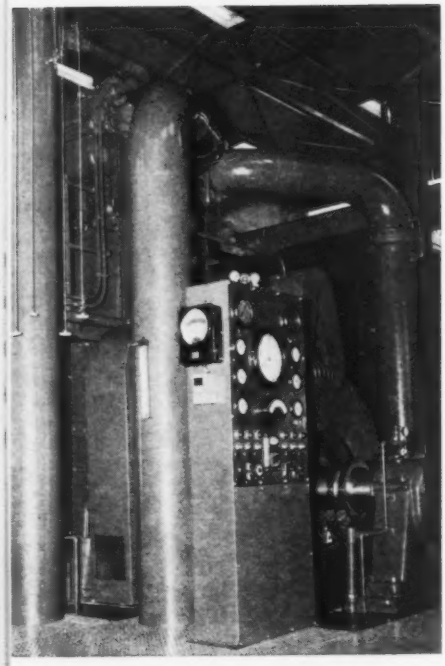

Fig. 7—View of engine control panel, 16-in. air intake, and water-jacketed exhaust

Features of a Modern Diesel-Pump Station

(Continued from page 221)

oil coolers placed in the discharge lines outside the building. The oil then returns to the piston-cooling line. Oil for the engine bearings is taken from the sump by means of a small motor-driven rotary pump, is discharged through a lubricating-oil purifier containing a special cellulose pack, then through a small oil cooler, a Cuno filter, and to the engine bearings. In case the normal lube-oil supply to the bearings fails, the oil is automatically supplied from the piston-cooling oil line.

Crude oil is used for fuel and is taken directly from the main suction lines. The fuel is passed through a centrifuge where water and sediment are reduced to not more than .05 per cent. The clean fuel is stored in two 200-bbl. fuel tanks outside the engine room. From the outside fuel tanks, oil flows by gravity to 60-gal. day tanks located on the floor of the pump room. A small rotary pump, V-belt driven from the intermediate shaft of the main speed increaser, transfers the fuel from the day tank in the pump room through a duplex waste packed filter external to the engine, then through a combination scale trap and gas separator just ahead of the engine fuel-injection pump. A relief valve maintains the desired pressure on the suction of the main injection pump. The excess oil from the relief valve as well as oil from the engine bypass valve are returned to the day tank. A hand-operated fuel-transfer pump is used for starting.

Wide speed variation was a requirement to be met in the design of the equipment for this new station. The torsional analysis resulted in a peculiar arrangement whereby power to drive the pumps was taken off at the end of the engine opposite the flywheel. A floating shaft, having a flexible coupling at either end, connects the engine to the step-up gear. The coupling at the engine of the floating shaft is a Falk No. 85-AR Airflex, and at the gear end, a Gearflex coupling is used. The system is free of troublesome criticals or reversal of torque over the entire range between 170 and 250 r.p.m.

Probably the most notable feature of the Martinsville installation is the method of controlling the equipment. In front of each engine is a central control panel on which are mounted pressure gages, flow meter, alarms, and shut-down devices as indicated in Fig. 3. Normally the engine is controlled from the control panel, although the engine speed may be controlled from the generator switchboards or at the engine governor. Each unit is equipped with an orifice-type flow meter that indicates, inte-

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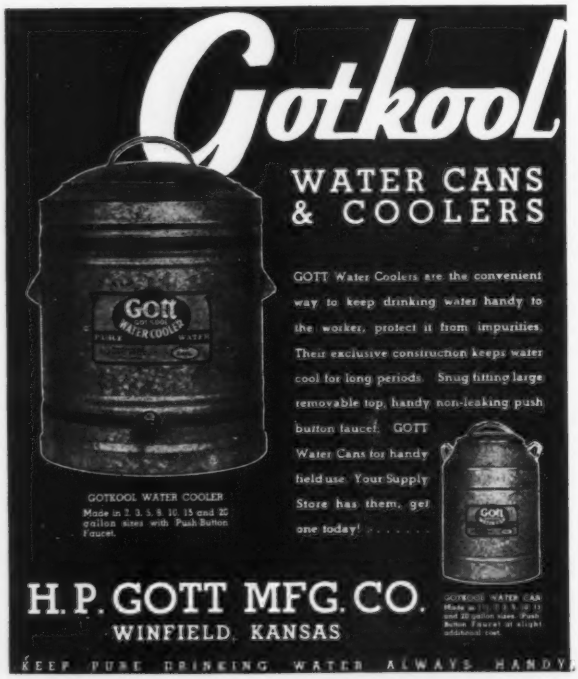
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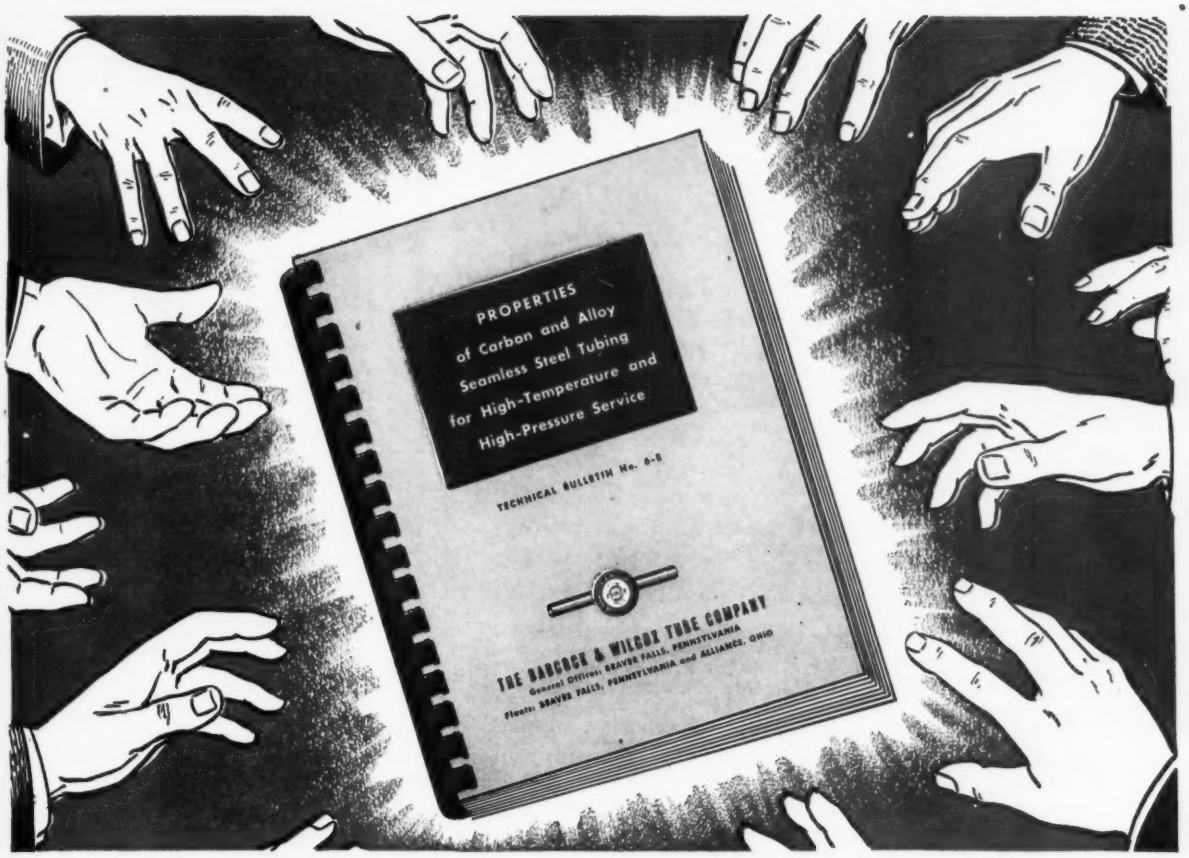

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grates, and records the rate of flow and line pressure. An alarm is set to sound a warning if pressure at discharge pump suction drops to 5 psi. If the suction pressure continues to drop, the unit will be shut down if the pressure reaches 0 psig. An instrument mounted on the side of the control panel, not shown in Fig. 3, will shut the engine down if the line pressure drops below a predetermined minimum or exceeds a predetermined maximum. Alarms sound a warning on low lubricating-oil pressure, high water temperatures, or low rate of flow in the jacket water system. In the event of trouble, the alarm circuit may be turned off for as much as 30 minutes by a mark-time switch. If the difficulty has not been eliminated by the period of time for which the mark-time switch is set, the alarm will again sound off and warn the operator.

When the station is down, one unit can be started without the benefit of a booster pump if one of the nearby working tanks is on stream. This is not always the case, however, so a routine has been adopted of switching one of the 60-hp. booster pumps over to central station power until the first generator unit is on the line. The booster pumps are started and stopped from the engine room and the engineer can switch to central station power and back again without leaving the engine room. In case the generator unit is knocked off the line for any reason, a relay automatically throws the lighting circuit over to central-station power.

At first the new diesel station looked strange and complicated to our operating engineers, some of whom had spent half a lifetime at the old steam station. But in a few days they were synchronizing the two generator units and shifting the load from one to the other. They soon became familiar with the beat of the heavy diesels and were pleased with their flexibility and quick responsiveness to small movements of the remote speed control key. The flow meters have proved very helpful in making adjustments in pumping rate and have remained surprisingly accurate. Cylinder firing pressures are taken by the division machinists once each month and reported to the division superintendent and the engineering department. Detergent-type lubricating oil is used and oil samples are checked in the laboratory at regular intervals. Two pistons have been pulled for inspection in the year and a half that the station has been operating, but the pumps and gears have not been touched. Only three injection nozzles have been changed, but the firing pressures and exhaust temperatures are normal and quite uniform. This is record performance which seems to demonstrate that ordinary sweet crude is good fuel if properly cleaned. Major overhauls are planned at 2-year intervals.

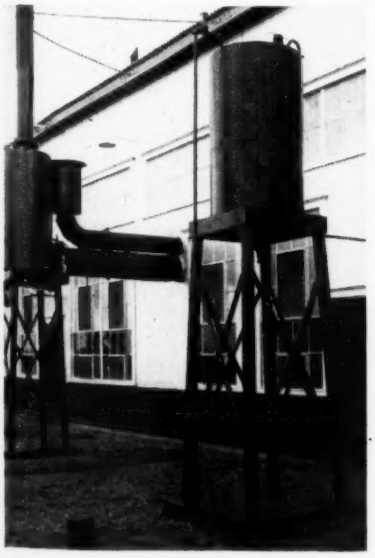
PIPE-LINE SUGGESTIONS

Ladders in Basement of Compressor Station

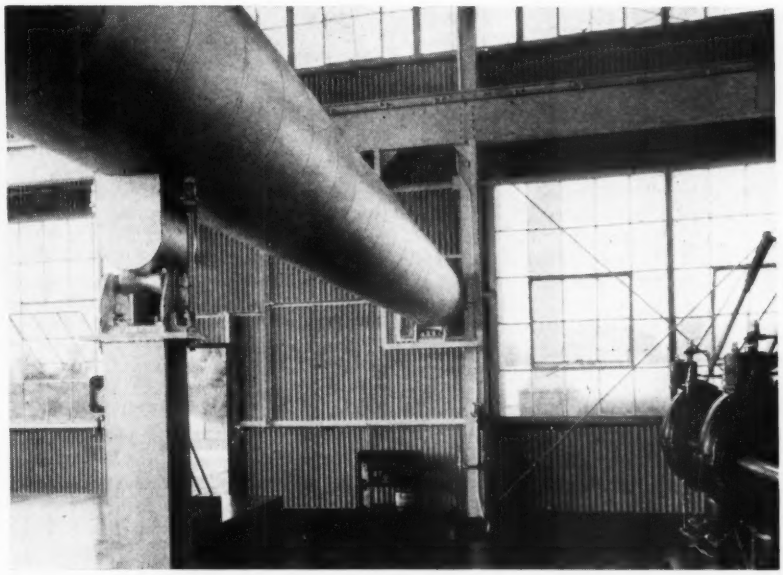
EMERGENCY steel ladders have been permanently installed in the cellar of a Kansas compressor station on a major gas transmission line. These ladders make it possible for operators to climb quickly out of any basement window in case a dangerous situation should occur.

Auxiliary Fuel Tank for Diesel-Engine Station

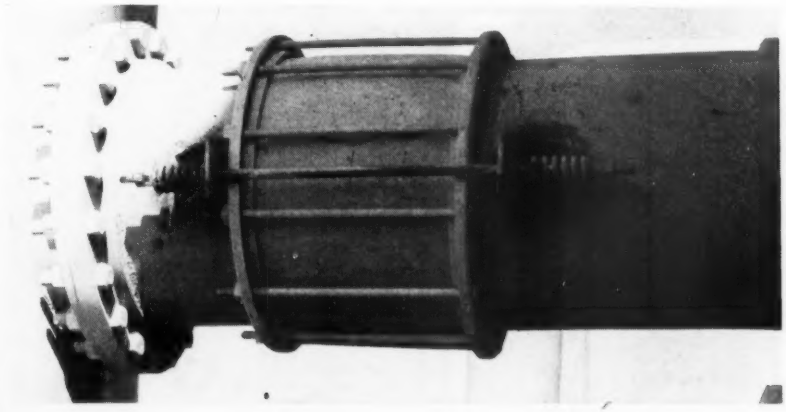
AN auxiliary fuel-oil tank has been placed on a platform near the engine room of a crude-oil pump station in Texas operating with diesel engines. This auxiliary tank supplies fuel to the engines during periods when the main fuel tankage and lines are being cleaned. The main fuel tankage is placed several hundred feet away on sloping ground rising from the station. The manner in which the auxiliary fuel tank has been installed insures that the main fuel system may be thoroughly cleaned without interrupting normal operation of the station.



Compressor Exhaust Pipe Installation



TWO devices have been installed on exhaust pipes at a Missouri compressor station on a gas pipe line. Inside the station the pipe is supported on conventional rollers close to the wall. At the interior of the engine room a special means of supporting the pipe has been used, consisting of a cylindrical extension below the insulated pipe. This extension is supported on roller mounted on a steel post. Another roller on top of the cylinder is held firmly to the top side of the cylinder extension by means of rods bolted to a plate on top of the steel post. As a result of tying down the upper roller in this way, the exhaust pipe is prevented from jumping off the lower roller in case of back firing.



At the expansion joint outside the station building, there are special shock absorbers. Each of these consists of a steel rod with a spring at each end. The rod is held by two gudgeons across the expansion joint. The purpose is to dampen the effects of backfiring.

NEW combined with OLD — to make Atlantic's Ultramodern Wax Plant

FEW processes, or groups of processes, in the modern refinery retain so much of the old art, of the "know how" developed through the history of the industry as contrasted to the ultramodern new types of processes—as does the average efficient plant for the manufacture of refined paraffin waxes. Producing one of the earliest specialities to be developed by the then essentially nontechnical refining industry, beginning to thrive before the turn of the twentieth century, the refining of wax still consists of three essential steps—separation of solid wax from liquid oil by freezing-point difference, separation of different grades according to melting-point range, and decolorization by chemical and physical reagents.

Atlantic Refining Co. is one of the outstanding refiners of paraffin waxes and has been in this phase of oil refining since the early days of the petroleum business. Originally the wax and lubricating-oil plants were operated at Point Breeze (Philadelphia), Pa., solely on Pennsylvania crude, later the plant introduced Mid-Continent and similar crudes and now operates entirely on these non-Pennsylvania stocks. One of the pioneers in the business, the Atlantic staff's store of techniques and knowledge of how to handle wax and wax refining is outstandingly comprehensive and complete.

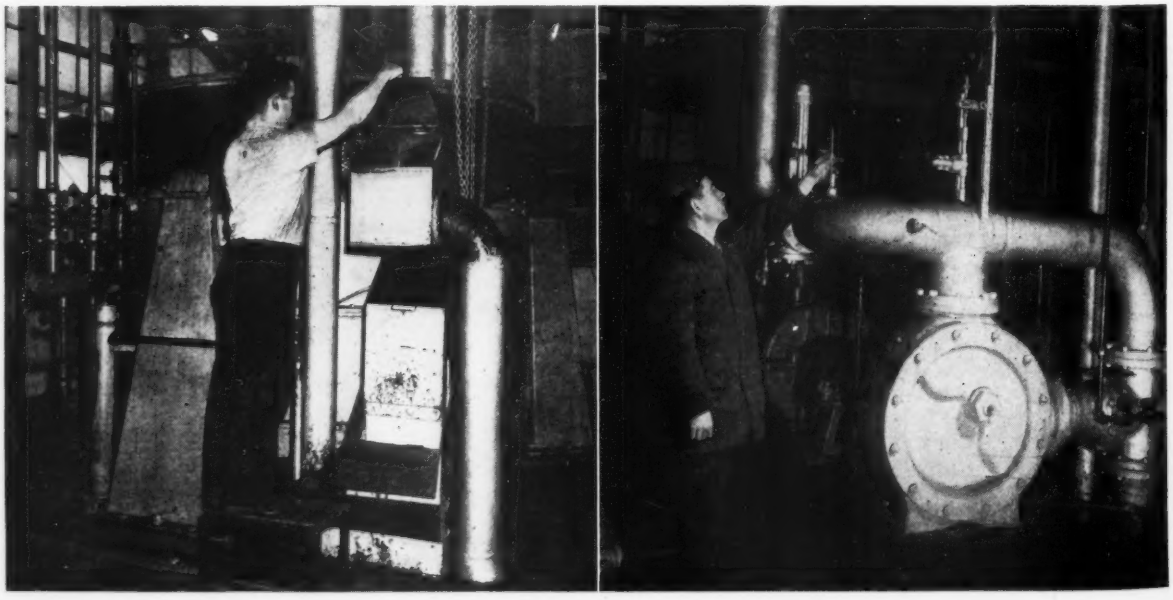
Vacuum Fractionator Added

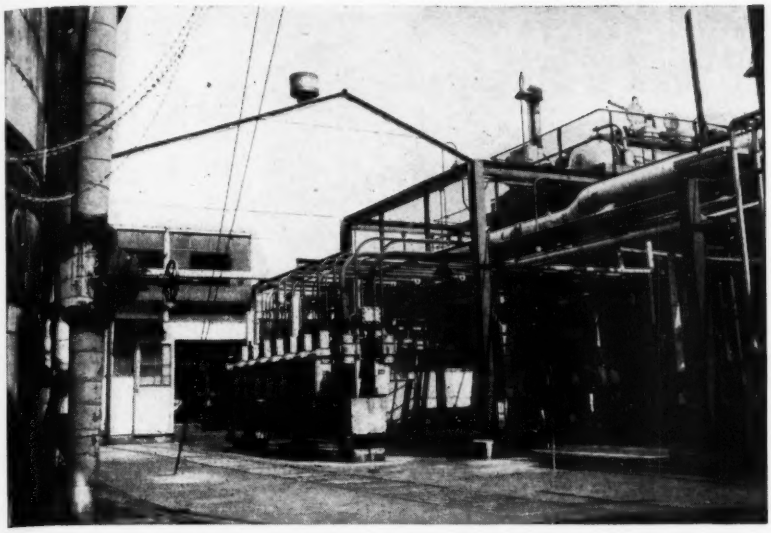
Recently Atlantic added a 2,500-bbl. vacuum fractionator unit to its wax plant, to simplify the process and effect improvements and economies in both process and product. This unit includes a Petrochem furnace, a fractionator tower 6 ft. in diameter by 60 ft. high, two-stage steam vacuum jets and the necessary exchangers, condensers, pumps, and other auxiliaries. This unit was built in 1947 by M. W. Kellogg Co., and its purpose and operating details are given later in this article.

Other units in the system include a conventional wax press plant having 36 presses, where the crystallized wax from the wax distillate is removed to yield slack wax and pressed distillate from which finished neutrals are made. An interesting historical item in connection with this plant is the long service life of "Big Mary," a large, steam-driven, double-acting, duplex charge pump which supplies chilled wax distillate to the presses and which has been in operation more than 30 years. This one pump will handle 12,000 bbl. per day of chilled distillate at 300 psig., and would handle still more if needed. This pump has been shut down for repairs just once during the last 3 years (except for repacking) and is in operation every minute that the presses are running wax distillate.

Auxiliary to the wax press unit are a set of coolers and an assembly

Left: Emulsion deoiling unit. W. Mannion inspecting wax cake flow from a centrifuge. Right: James F. Campbell, supervisor, checks emulsion temperature at one of the emulsifiers





Emulsion deoiling unit, showing refrigeration unit on top of platform, water pumps and switch boxes on ground level

of chillers which reduce the waxy oil to the desired pressing temperature, after a preliminary cooling by water at essentially atmospheric temperature.

The exchangers cooling the incoming wax distillate by exchange with pressed oil were designed under the direction of the late J. W. Van Dyke, (former president and chairman of the board) with Atlantic for many years and well known as one of the leaders and pioneers in the refining industry. These exchangers consist essentially of an outer jacket about 26 in. in diameter and concentric with the jacket, through which the pressed oil passes, extends a 20-in. rotating line to which fixed scrapers are attached. The scrapers remove coatings of wax which may solidify on the inside surface of the outer jacket.

The second decidedly modern unit in the wax plant is the Schutte emulsion deoiling unit, installed in 1947 by Lummus Co. It includes in addition to the customary tankage, pumps, exchangers, etc., the main centrifugal pump mixers or emulsifiers and large centrifuges equipped with 7-ft.-diameter baskets for separation of oil-emulsion and wax; three sets of emulsifiers, centrifuges, and recycle pumps are provided.

This system of deoiling slack wax was developed to solve the problems incident to refining of wax containing appreciable amounts of liquid oil. As obtained from conventional presses, the wax crystals have formed a matrix containing oil wherein the crystals impede the flow of the oil from the wax matrix. By mixing and emulsifying the oil-wax mixture with a nonsolvent liquid such as water, and chilling to crystallize the wax, retaining the water as the continuous phase, the resultant emulsified liquid-solid mixture becomes an easily filterable system. The emulsification and crystallization steps usually in this process are carried out simultaneously, the cooling being accomplished by introducing the water phase at such a temperature below the melting point or solidification point of the wax that crystallization is effected at the same time the oil, which is liquid at that temperature, is emulsified.

By charging this mixture to a basket-type centrifuge shrinkage of the wax cake from centrifugal force produces a squeezing action which helps materially in removal of the oil while retaining cake porosity which aids in speedy filtering or separation. A water wash introduced at a temperature somewhat above the emulsion temperature aids in the oil removal.

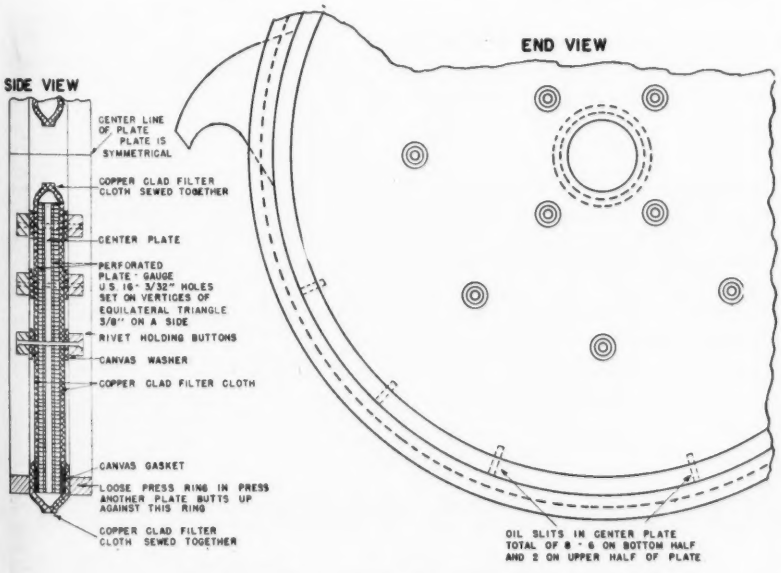
Design of Centrifuge Bowl

One of the outstanding developments in the system is the design and operating technique of a centrifuge bowl. These bowls, 84 in. in diameter and 60 in. high, are built with a solid outer cylindrical wall. A flange called the "lip" of the bowl, is located near the top of the cylinder. This lip forms an angle of approximately 45° with the vertical wall of the bowl. Near the point where the lip joins the wall, a series of holes is drilled, for the exit of the water layer formed against the vertical cylindrical wall when the centrifuge is in operation.

The lip extends inward and its width is so adjusted with the speed of rotation of the bowl and the proportions of oil-water and of wax that the inner segment of the highly aerated, porous wax layer, innermost of the three layers of water, water-oil emulsion, and wax in the bowl, "spills over" the edge of the lip and is thrown continuously by centrifugal force into a separate annular space where it is melted by steam.

Intermediate between the wax layer inside, and the water layer outside against the bowl wall, is a water-oil emulsion layer in which some of the wax is submerged, which is referred to as "submerged wax" to identify it. This submerged wax-oil-water emulsion mixture is not permitted to escape from the bowl and is held therein so that gradually the oil-water emulsion and water gravitate to the wall and escape through the series of holes mentioned above, to be thrown into another annular space separate from that in which wax is caught.

A water wash line is introduced into the approximate center of the


SIDE VIEW
END VIEW
CENTER LINE OF PLATE PLATE IS SYMMETRICAL
COPPER CLAD FILTER CLOTH SEWED TOGETHER
CENTER PLATE
PERFORATED PLATE - GAUGE U.S. 16 - 3/32" HOLES SET ON VERTICES OF EQUILATERAL TRIANGLE 3/8" ON A SIDE
RIVET HOLDING BUTTONS
CANVAS WASHER
COPPER CLAD FILTER CLOTH
CANVAS GASKET
LOOSE PRESS RING IN PRESS ANOTHER PLATE BUTTS UP AGAINST THIS RING
COPPER CLAD FILTER CLOTH SEWED TOGETHER
OIL SLITS IN CENTER PLATE TOTAL OF 8 - 6 ON BOTTOM HALF AND 2 ON UPPER HALF OF PLATE

Details of filter press plate construction

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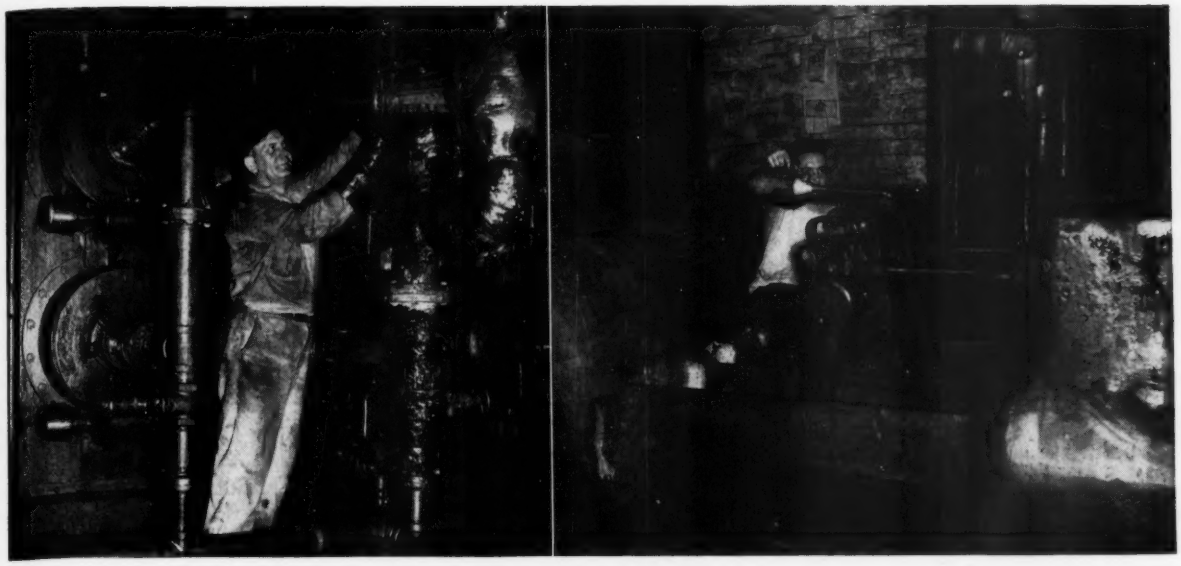


Left: Wax pressers chillers—R. Watkinson, preparing to warm the brine wash chillers. Right: Wax presses—E. McGee lubricating "Big Mary" charge pump presses

bowl with a spray head directing a water spray against the rapidly rotating cylinder of the wax layer; the water washes the wax relatively free of emulsion and aids in creating a "squeezing action" to remove the oil and water from the wax which spills over and out as mentioned.

The sweater units are conventional with various improvements in equipment and in technique as developed through long experience. Each sweat room includes up to 52 pans in one to four banks, with the conventional steam and water lines for heating, floating, and chilling the contents. Filling, chilling, and sweating, as well as drawoff of sweated product follow specified though variable routines.

Batch-type agitators are employed for acid treating to decolor the wax, and are operated in essentially the conventional manner. The sour oil is neutralized with soda ash in conventional manner and then percolated through decolorizing clay.

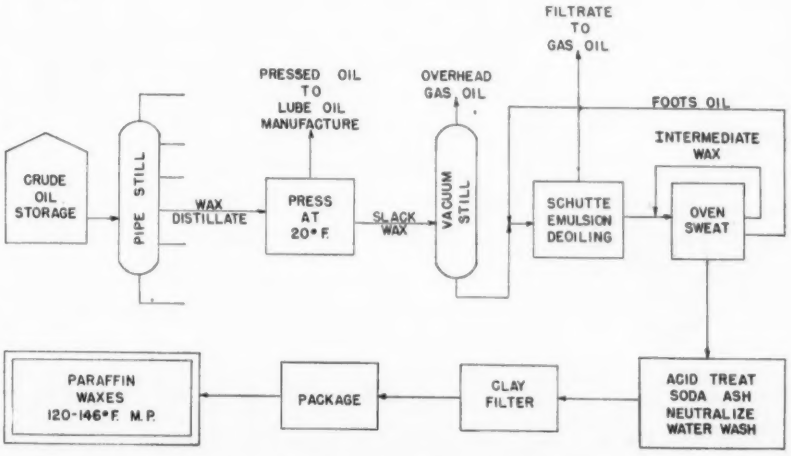
Packaging machinery includes presses for cooling molten wax into slabs of approximately 10 lb. each; a wax drum chilling unit for filling barrels with finished wax, and means for making up cartons, boxes and other forms of wax packaging. Bulk liquid shipments are also made.

Operation of the Process

While any typical wax-bearing crude may be processed in this plant, the usual charge stock is derived from East Texas crude or the equivalent. About 30 per cent of the crude is "cut" into the raw wax distillate, as a tower sidestream. This raw distillate passes to a water cooler, then into the Van Dyke coolers in exchange with cold pressed distillate, and eventually to the brine chillers. The water in the first coolers is essentially atmospheric temperature and cools the distillate to about 100° F. The pressed oil reduces the temperature to about 70° F. in the Van Dyke units. Finally, cold brine in the screw scraper-equipped chillers reduces the distillate to the required temperature, usually about 20° F., and this mass is forced by a pump such as Big Mary into the manifolded press charge line.

In the presses the wax is deposited on canvas in the conventional manner, entering through the line or conduit formed by the open centers of the plates, and the oil passes through and drops into the trough below for transfer to pressed oil tanks or is cycled through the Van Dyke coolers mentioned above. This oil is forced out between the plates through the interstices between plates, canvases, and spacing rings. Construction of these plate assemblies is illustrated. It is a most interesting bit of know-how that the perforated plate between the solid plate and the canvas must be dented by striking with a special hammer prior to installing the canvas; otherwise the flow of oil will be retarded and the press operation hindered seriously. After its exit from the presses to the pressed oil rundown tanks, the oil is out of the picture of wax manufacture.

Wax removal from the presses is the conventional hand-dumping operation. An hydraulic ram which, before an empty press is put on stream, closes the press plates together, is retracted to give space for pulling the plates apart; a workman on each side with a paddle-type instrument pries away the spacing ring and pushes it backward; then working swiftly and in unison, the men insert the blades of their paddles be-



Flow chart of paraffin wax manufacturing process

hind the wax cake, break it smoothly away and drop it in irregular pieces into the screw conveyor, which is directly beneath the press, and which carries the wax cake to a wax-melting tank.

The oil-rich wax cake is melted by exhaust steam from pumps and other steam-driven prime movers and goes to intermediate tankage en route to the wax vacuum still. This is equipped with three two-stage steam-jet exhausters and operates at about 18 mm. of mercury absolute pressure; the incoming wax is heated by exchange before entering the tower. A Petrochem heater furnishes sufficient reboiler heat to evaporate overhead the light or gas oil portion of the mixed wax and oil; usually this temperature is not higher than 600° F. and no steam is employed in the still or tower.

In this unit, as in most cases of wax handling, all lines must be "traced" with smaller steam lines which are installed directly against the wax-carrying pipe, and both lines enclosed within the same lagging. The partially deoiled wax is taken off as a bottoms product from the tower, while the gas oil is taken as an overhead, cooled well below its flash point but well above its solidifying temperature and is sent to storage as cracking stock or for other purposes for which "middle distillates" are used. All tankage for these products must be steam-coil fitted, to liquefy the contents before they are pumped.

This operation yields about 25 per cent gas oil and 75 per cent slack wax bottoms. The wax is then sent to the emulsion deoiling unit, which is a two-stage, crossrecycle operation.

The wax enters first a variable-speed gear pump, thence into the emulsifier, along with a small amount of air, and the water which is emulsified with the oil and wax. The water performs three functions: it is used to emulsify with the oil present with the wax; the amount coming is governed by a control valve which is regulated by the temperature of the final emulsion. Depending on the cooling water's original temperature and on operating conditions the ratio of water to wax may vary from 1:1 to 5:1. The other water function is to take up the sensible heat in the oil wax, also the latent heat of solidification, as well as the heat generated in mixing to form the emulsion.

The temperature of the mixture is controlled within a range of ½° F. This mix goes out of the emulsifier through a back-pressure valve which maintains about 50 psi. pressure on this stage in the system. The line to the centrifuge handles wax at a temperature of 15°-20° F. below its melting point; this is possible by the fact that the water is the continuous phase of the emulsion, preventing the coalesence of wax particles. Air admitted to the system aerates the wax which, when it is emerging from the centrifuge bowl has the appearance of coarse cake batter.

The centrifuge step separates the product into filtrate plus water stream, and the deoiled, solid wax cake. The housing or annular space in which the wax is caught as it emerges from the bowl is steam-jacketed to melt the wax and permit pumping. The water-oil pump takes suction near the bottom of the rundown tank and the water so picked up is returned to the emulsifier for reuse. In charging the centrifuge, the water-oil mix passes through an orifice by which the total amount of liquid to be fed is controlled by a flow controller. The steam condensate from the whole plant can be added to the recycle water so that little if any outside makeup water is needed. Steam from the vacuum steam jets is a major source of water makeup in the closed system. The water-oil emulsion must be heated of course to break the emulsion.

The filtrate from the first deoiling step is carried through a second cycle essentially like the first; in the Atlantic setup two centrifuges are employed for the first deoiling, while

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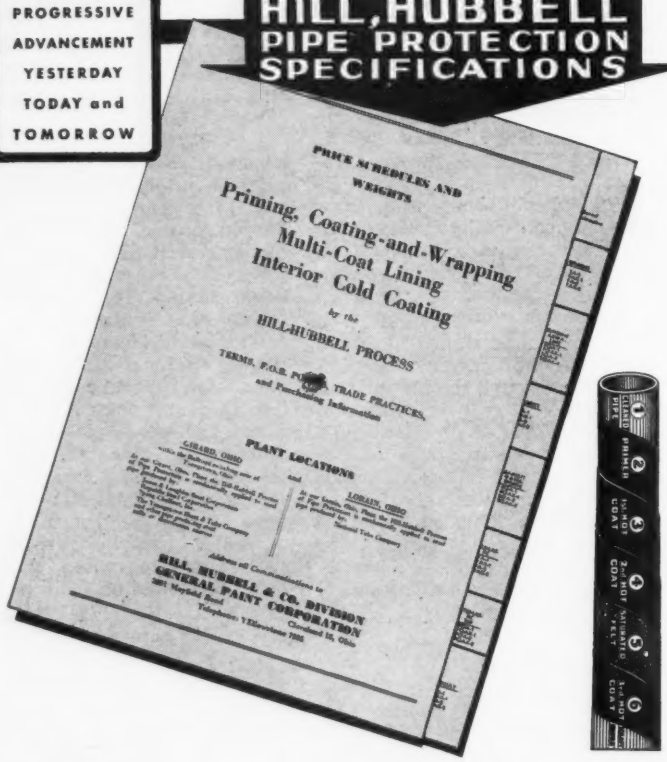

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one machine handles the filtrate which is remulsified and processed to recover more oil and an intermediate wax which is recycled to the first stage. The process reduces by 0.5 per cent the oil in the charged wax. The cake from the first step, at about 122° F. melting point, is sent to the sweaters, and some 500 bbl. per day of foots oil from the sweating operation is recycled to the second deoiling step to recover more wax from the oil-wax mixture. The final filtrate essentially free of marketable wax, is about 85°F. melting point.

Typical details of this operation are as follows:

	Barrels per day	Melting point (°F.)	Oil moisture content (%)
Charge:			
Raw wax	2,050	118	16
Foots oil	495	98	*45
Product:			
Cake	1,837	121	7.25
Filtrate	708	85	...

*Approximate.

The products are partly deoiled wax, and nearly completely dewaxed gas oil or filtrate which is stored and used as cracking unit charge stock. The wax is sent as liquid to the sweater unit and is run into pans containing water. When sufficient wax is in the pans, cold water is pumped through coils in the wax layer to solidify the wax, the lower level of which is above a wire screen installed in each pan. As the supporting water layer is drained away the solid wax cake rests on this screen. When the water is drained, the room is raised to a predetermined temperature by means of closed steam heating to liquefy and drain away the remaining oil and wax which melts below a given temperature; the water coils are now used to circulate hot water for heating; at the end of the sweating period the remaining wax is melted by raising the temperature rapidly, and is sent to rundown tanks from which it is pumped to the acid-treating agitators. The oil and wax removed during the sweating period is stored in steam-heated tanks, and is run to other sweat pans to recover the wax content of the next lower-melting-point grade, and so on until no more marketable wax can be recovered. The final foots oil may be recycled to the deoiling unit to recover wax.

The sweated wax is acid treated with 98 per cent sulfuric acid, usually at about 20 lb. per barrel of wax, to a predetermined color standard. This sour oil is neutralized and washed, then percolated through 30/60 mesh fuller's earth to standard color. The over-all finishing loss is 5 to 10 per cent total, since the product is almost pure hydrocarbon material, and taste, odor, and coloring matter are practically all the impurities removed by the treatment.

The entire wax plant is steam heated. A very ingenious system of manifolding for the various operations is installed, developed in many cases through the years by long and often bothersome and costly experience. Wax-plant employes are highly skilled in their work, have a great mass of experience, of know-how without which such a plant cannot be operated successfully. In spite of the good engineering and technical knowledge applied to various operations in the process the refining of wax is still essentially an art, far more than it is a science, in the opinion of well-informed refiners.

The over-all yield of wax varies somewhat for different stocks and under different methods of operation but the average may be considered to be of the order of about 10 per cent, based on the raw wax distillate. This value, in terms of original crude charged to the primary still, will vary widely of course, dependent on the crude being processed, its wax distillate content, and the wax concentration in this fraction.

The new spots in this system are the deoiling process and the raw wax vacuum distillation unit. These two steps, combined with the older, well-tried units make up an up-to-date wax-manufacturing system.

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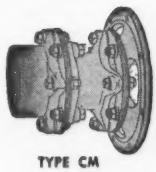
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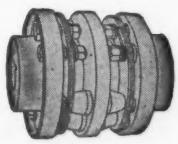
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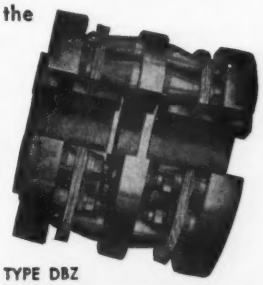
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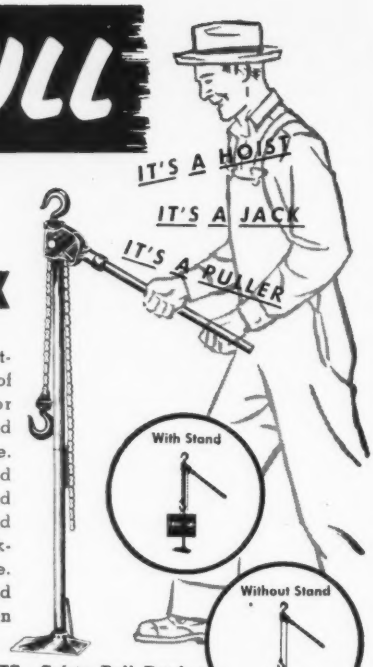

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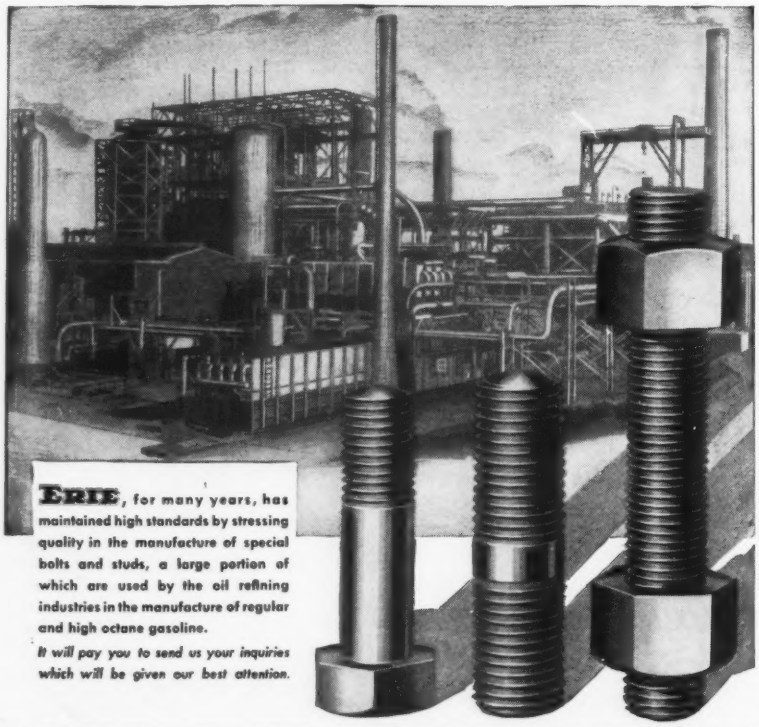

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QUESTIONS on TECHNOLOGY

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Underground Gasification Of Coal

Are there experiments on the burning of coal underground for heat or fuel gas? What does this mean to the petroleum industry?—B. C. P.

The gasification of coal in situ is not a new idea. J. D. Clendenin in "Underground Gasification," Chemical Engineering Progress, Vol. 43, No. 11, page 581, November 1947, states that active experimentation has been in progress for about 15 years and that the idea originated at least 70 years ago. Much of this work has been done in Britain, Belgium, and Russia. The Clendenin paper is a complete review of the situation and 31 references are shown.

The reason for gasification in position is to avoid the labor of mining. The following tabulation (from Clendenin) indicates the per-man per-month production of coal:

Situation—	Tons per man-month
Donbas, Russian miner	26.5
Chelyabinsk in Urals	61.25
Russian gasification at Donbas*	75-125*
Deep mine Pennsylvania bituminous	110
Bituminous strip mining in U. S.	213
Anthracite region of U. S.	61
Anthracite by stripping in U. S.	158

*Some reports state 315-370 tons, and a possibility of 500-600. Results of the "Experiment in Underground Gasification of Coal, Gorgas, Ala.," U. S. Bureau of Mines, Reports of Investigations 4164, August 1947, by Dowd et al, gave no clear picture of the amount of labor required. In general, the results do not indicate a great saving of labor.

The experiment at Gorgas, Ala., involved two main 170-ft. horizontal and parallel shafts in the coal seam with a 40-ft. crosscut connecting the ends of the two horizontal shafts making a U-shape passage. Air or oxygen and steam could be introduced into one (or the other) end of the U-shaped passage, and flue gas or fuel gas issued from the other end as indicated in Fig. 1. There were, of course, many other details: adit shafts, vision slots, thermocouples, 4-in. pipes leading to the surface, etc., which cannot be described here (see B. of M. R.I. 4164 mentioned above). Although a pressure of only 1.5 psig. was maintained, "burnouts" occurred and all of the adits had to be closed with bags of clay and a covering of gunite over the bags. This difficulty will probably not be important with deeper mines than the Gorgas test site. The Oil and Gas Journal of July 1, 1948, page 88, states that a second experiment is being planned whereby it is hoped that the average heating value of the gas can be increased from 47 B.t.u. per cu. ft. to perhaps 70-125 B.t.u.

Five types of blasting were used, namely, air, oxygen-air, oxygen-air-steam, oxygen-steam, and steam alone. Examples of test results for three of these types of blast are given in Table 1.

The efficiency of the air-blast run was 44.6 per cent. This means that 44.6 per cent of the heating value in the coal that was burned appeared in the make gas. The oxygen-air blast was not entirely representative because the vaporization facilities were not adquate.

No one knows the effect of such developments on the petroleum industry. At the moment, underground gasification is still in an experimental state. In general, it would seem that we are going to need any improvements in fuel production that are possible and that the petroleum industry will find itself in a more and more favorable position as these fundamentally difficult methods of fuel production are found to be necessary.

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4. Dowd, et al, Experiment in Underground Gasification of Coal, Gorgas, Ala., U. S. Bureau of Miles, Repts. Invest. 4164, Aug. 1947.
5. Earle, C. R., How Coal Is Burned in the Mines to Produce Power and Synthesis Gas, Power Plant Engineering, Sept. 1947, p. 74.
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TABLE 1—QUANTITY AND QUALITY OF GASES IN SOME GORGAS RUNS

	Air blast	Steam blast	Oxygen-air blast
Rate of production, cu. ft. per min.	1,400	200	1,000
Heating value of gas, B.t.u. per cu. ft.	55	222	150
Gas composition, volume per cent:			
Carbon dioxide	16.2	26.0	55.4
Oxygen	0.4	1.0	1.4
Illuminants	0.2	0.4	0.2
Hydrogen	7.4	34.4	18.8
Carbon monoxide	4.2	19.2	12.6
Methane	1.4	4.3	4.6
Nitrogen	70.2	14.7	7.0

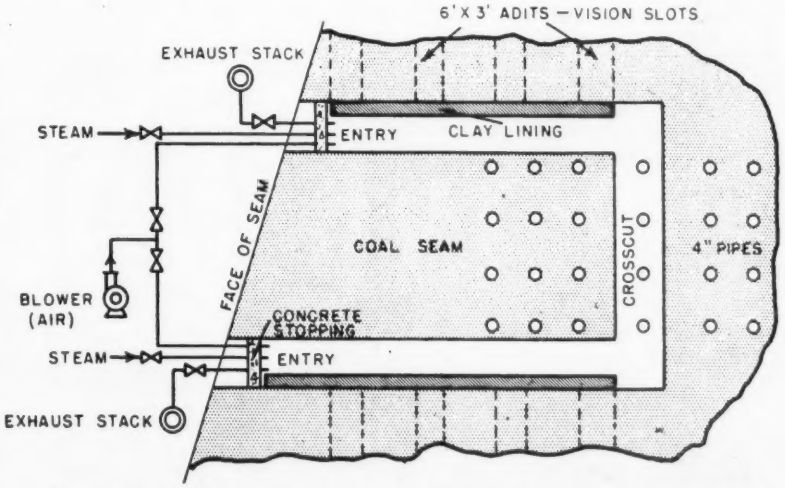

Fig. 1—Plan view of area in neck of land about 300 by 150 ft. containing coal seam 36 in. thick, as isolated for tests at Gorgas mine of Alabama Power Co. Combustion ducts 170 and 140 ft. long connected by 46-ft. cross-cut. (Courtesy Coal Age)

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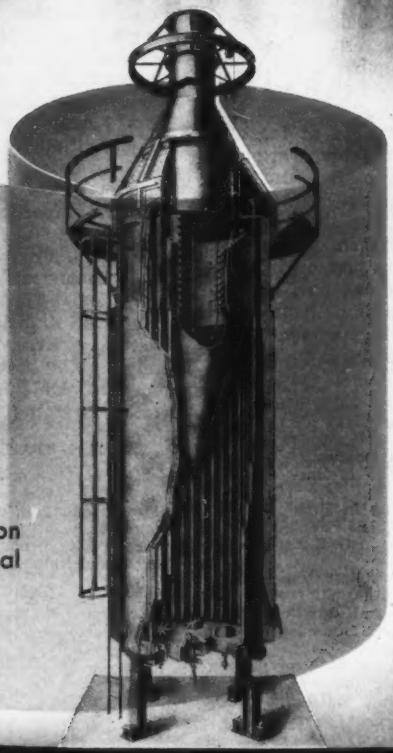
Uniform heat distribution per pass being a most important essential to efficient operation of multi-pass furnaces, it is significant that Petro-Chem Iso-Flow Furnaces are unequaled for uniform heat distribution per pass because their cylindrical design and vertical tubes provide a perfectly symmetrical pattern on the fluid and combustion sides, regardless of the number of passes required.



Each bank of tubes (each pass) is equi-distant from the flame.

●

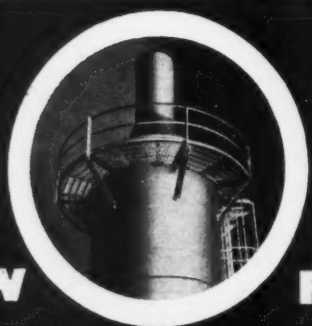
Each bank of tubes (each pass) is exposed to the same heat intensity.

●

Length of fluid travel for each pass (including crossovers) is identical from inlet to outlet.

●

All of the above give the minimum variation in tube wall temperature and are essential for critical high temperature operation.



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ENGINEERING fundamentals

Pressure and Saturation Distribution In a Radial System

IN the radial flow system, pressure distribution during single-phase flow can be readily expressed by using Darcy's law for the system. This states that pressure should vary linearly with the logarithm of the radius as given by the term:

$$\frac{P_x - P_w}{\ln R_x/R_w} = \text{constant}$$

(This was discussed in Engineering Fundamentals No. 315.)

For the radial-flow system where oil and gas (two-phase flow) are flowing under steady state conditions the pressure gradient across the system can also be calculated and along with it the oil saturation at any radius can be found. The expression is not so simple as that for the single-phase system given above but the manner of arriving at it is simple and direct.

The flow formula for radial, steady state, two-phase flow of oil and gas is (Engineering Fundamentals No. 343):

$$Q_o = \frac{7.07\,kh}{\ln R_e/R_w}\int_{P_w}^{P_e}\frac{k_o/k}{\mu_o\beta}\,dp \quad (1)$$

where Q_o is in barrels per day, pressure is in pounds per square inch, and R_e, R_w and h are in feet. This flow can also be expressed over any fraction of the system as well as over the entire system. Thus, in terms of a radius R_x, at any point in the system where the pressure is P_x, the following is true:

$$Q_o = \frac{7.07\,kh}{\ln R_x/R_w}\int_{P_w}^{P_x}\frac{k_o/k}{\mu_o\beta}\,dp \quad (2)$$

Dividing Equation 2 by Equation 1 gives:

$$\frac{\ln R_x/R_w}{\ln R_e/R_w} = \frac{\displaystyle\int_{P_w}^{P_x}\frac{k_o/k}{\mu_o\beta}\,dp}{\displaystyle\int_{P_w}^{P_e}\frac{k_o/k}{\mu_o\beta}\,dp} \quad (3)$$

or in other words:

$$\frac{\displaystyle\int_{P_w}^{P_x}\frac{k_o/k}{\mu_o\beta}\,dp}{\ln R_x/R_w} = \text{constant}.$$

This is the two-phase flow condition analogous to the first stated condition for single-phase flow, and which can be used to calculate pressure at a given radius.

The steps in evaluating pressure P_x at radius R_x are, therefore:

1. Calculate the function of $\frac{k_o/k}{\mu_o\beta}$ versus pressure for the system at the given gas-oil-ratio value. Fig. 1 is an illustration of such a function. (See Engineering Fundamentals No. 343).

2. Choose the value of R_x for which the pressure is desired and substitute in Equation 3, in which everything is now known except

$$\int_{P_w}^{P_x}\frac{k_o/k}{\mu_o\beta}\,dp$$

The integral now has a definite value assigned to it.

3. Find a pressure P_x between P_w and P_e such that the area on Fig. 1 between P_w and P_x is equal to the assigned value of the integral from the preceding step. This requires a trial-and-error evaluation of P_x. When found, it is the pressure at the R_x chosen in step 1.

4. Repeat for any value of R_x desired.

5. At the point P_x read the value of $\frac{k_o/k}{\mu_o\beta}$. Knowing μ_o and β from the pressure, the value of k_o/k can be solved for.

6. Using the k_o/k so found, read the saturation from a plot of S_o versus relative permeability. This is the oil saturation at the radius R_x.

7. Repeat for all values of R_x desired.

From the above sequence, pressure and saturation can be evaluated for all radii between R_w and R_e. The distribution so found is characteristic of a radial system. Fig. 2 is a typical plot. Of course, since a value of gas-oil ratio must be assigned to define the steady state, a different set of curves would be obtained for each gas-oil ratio chosen.

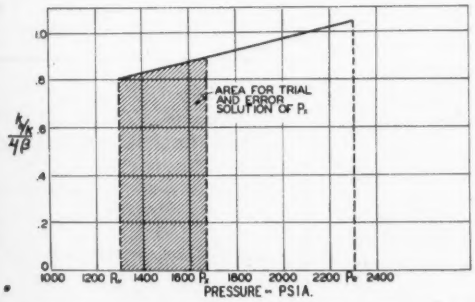


Fig. 1—Variation of flow function between P_e and P_w showing manner of arrival at P_x

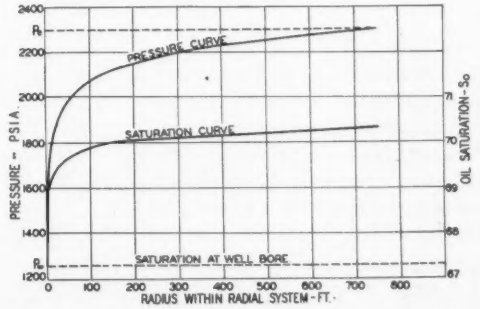
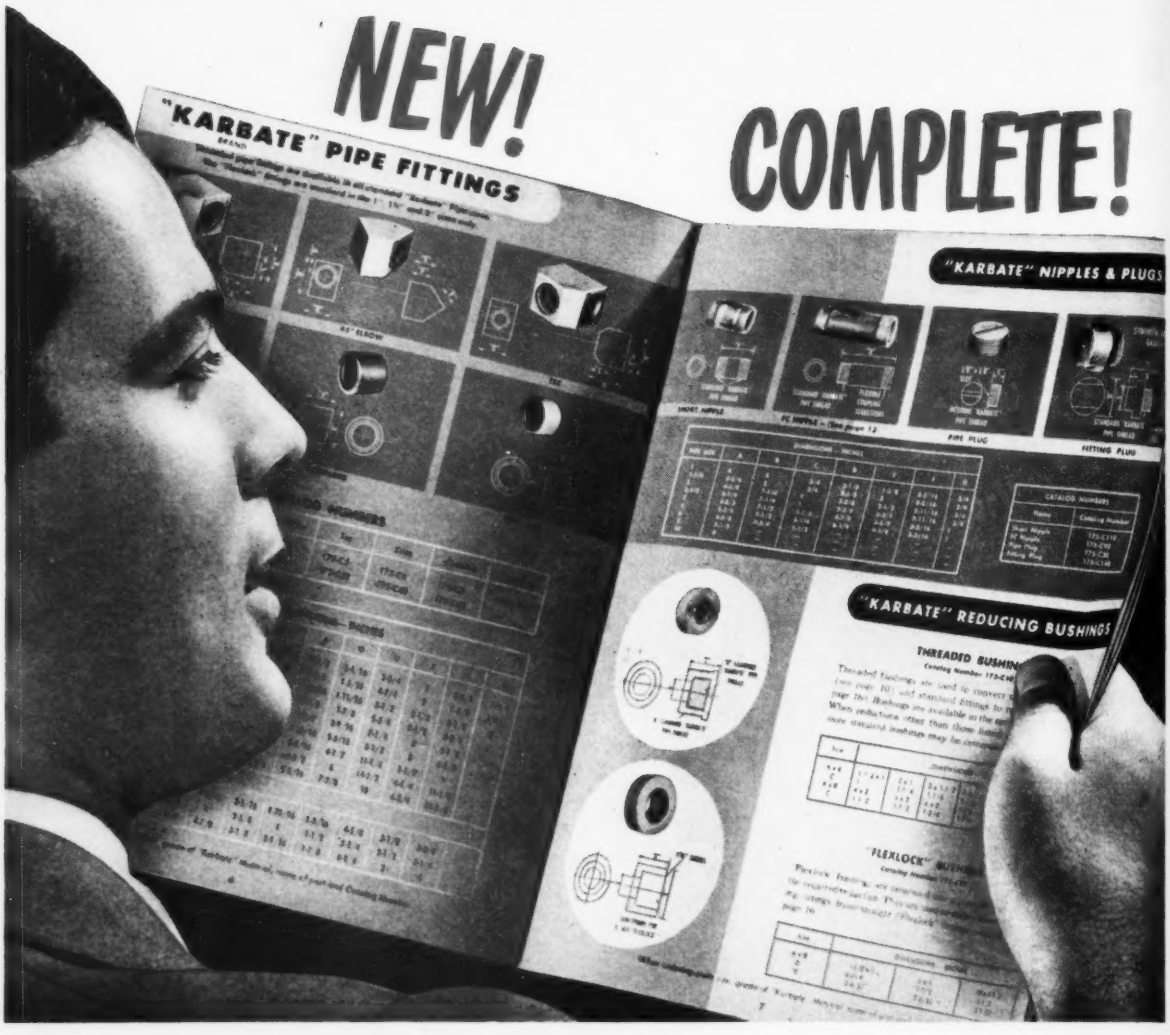


Fig. 2—Typical variation of pressure and oil saturation in radial system; two-phase flow. R_e = 750 ft. R_w = 0.25 ft.

Series by Dr. John C. Calhoun, Jr., Chairman, Petroleum Engineering School, University of Oklahoma



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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Types of Tank Cars

THE ICC (Interstate Commerce Commission), A.A.R. (Association of American Railroads), A.R.A. (American Railway Association), and USG (United States Government) have regulations, specifications, and recommendations concerning tank cars and tanks mounted on cars.

The kinds of tank cars commonly employed for various petroleum liquids or materials handled by petroleum refineries are indicated in Table 1 (see back of this page). The letters following each material indicate the kind of material, the kind of service, or the kind of tank, and the letters have the following meanings:

C.L.—Corrosive liquid.
E.B.—Class "B" explosives.
I.G.—Inflammable compressed gas.
I.L.—Inflammable liquid.
I.S.—Inflammable solid.
L.L.—Lead lined.
N.—Solid nickel.
N.G.—Noninflammable compressed gas.
N.R.—Nonregulatory commodities not subject to ICC but they may be combustible or corrosive.
O.M.—Oxidizing material.
P.B.—Poisonous liquid or solid, Class "B."
R.L.—Rubber lined.
W.—Welded tank.

The designation letters of the A.A.R. for Class "T," tank-car type cars are defined as follows:

"TA"—Tank car equipped with container of ICC Specification 103A, 103AW, 103C, and 103CW. Also A.R.A. II, A.R.A. III, or ICC 103 if containers and appurtenances were originally designed or subsequently reconstructed to comply with the requirements for ICC 103A cars.

"TG"—Tank car having one or more glass-lined containers.

"TL"—Tank car equipped with container lined with any material other than glass.

"TM"—Tank car equipped with container of A.R.A. or A.A.R. Specification I, II, III, III Experimental Welded Seams, IV, 203, 203W, 203X or ICC Specification 103, 103W, 104, 104W or Specification Emergency USG-A, USG-B or USG-C.

"TMU"—Tank car equipped with containers of A.R.A. Specification VI, B.E. Specification 27, ICC Specification 27, 106A500, 106A800 or 107A**** series.

"TP"—Tank car equipped with container of A.R.A. Specification IV, IV-A, V, or ICC Specification 104, 104A, 104AW, 105, 105A300, 105A300W, 105A400, 105A500, 105A500W, 105A600 or 105A600W.

"TR"—Tank car equipped with container of A.R.A. or A.A.R. Specification 201A35, 201A35 Special, 201A35W, 201A35X, or ICC Specification 103AL and 103C-AL.

"TW"—Tank car equipped with one or more wooden containers.

The letter "I" may also be affixed to the designating letters as TAI, TGI, etc., indicating that the tanks are insulated. The designation letters are related to Shipping Container Specifications as shown in Table 2.

TABLE 2—TANK-CAR DESIGNATION LETTERS AND CONTAINER SPECIFICATIONS

Shipping container specification class	"T" Designation						
	TA	TL	TM	TMU	TP	TR	TW
A.R.A. I	..	..	x	..	..	..	..
A.R.A. II	..	..	x	..	..	..	..
A.R.A. II (Note 1)	x	..	..	..	..	..	..
A.R.A. III	..	..	x	..	..	..	..
A.R.A. III (Note 1)	x	..	..	..	..	..	..
A.R.A. III (Exp. Welded Seams)	..	..	x	..	..	..	..
A.R.A. IV	..	..	x	..	..	..	..
A.R.A. IV (Note 2)	..	..	..	..	x	..	..
A.R.A. IV-A	..	..	..	..	x	..	..
A.R.A. V	..	..	..	..	x	..	..
A.R.A. VI	..	..	..	x	..	..	..
A.R.A. 201A35	..	..	..	..	..	x	..
A.A.R. 201A35 (Special)	..	..	..	..	..	x	..
A.A.R. 201A35W	..	..	..	..	..	x	..
A.A.R. 201A35X	..	..	..	..	..	x	..
A.A.R. 203	..	..	x	..	..	..	..
A.A.R. 203W	..	..	x	..	..	..	..
A.A.R. 203X	..	..	x	..	..	..	..
B.E. 27	..	..	..	x	..	..	..
ICC 27	..	..	..	x	..	..	..
ICC 103	..	..	x	..	..	..	..
ICC 103W	..	..	x	..	..	..	..
ICC 103A	x	..	..	..	..	..	..
ICC 103AW	x	..	..	..	..	..	..
ICC 103AL	..	..	..	..	..	x	..
ICC 103B	..	x	..	..	..	..	..
ICC 103BW	..	x	..	..	..	..	..
ICC 103C	x	..	..	..	..	..	..
ICC 103CW	x	..	..	..	..	..	..
ICC 103C-AL	..	..	..	..	..	x	..
ICC 104	..	..	x	..	..	..	..
ICC 104W	..	..	x	..	..	..	..
ICC 104 (Note 2)	..	..	..	..	x	..	..
ICC 104A	..	..	..	..	x	..	..
ICC 104AW	..	..	..	..	x	..	..
ICC 105	..	..	..	..	x	..	..
ICC 105A300	..	..	..	..	x	..	..
ICC 105A300W	..	..	..	..	x	..	..
ICC 105A400	..	..	..	..	x	..	..
ICC 105A400W	..	..	..	..	x	..	..
ICC 105A500	..	..	..	..	x	..	..
ICC 105A500W	..	..	..	..	x	..	..
ICC 105A600	..	..	..	..	x	..	..
ICC 105A600W	..	..	..	..	x	..	..
ICC 106A500	..	..	..	x	..	..	..
ICC 106A800	..	..	..	x	..	..	..
ICC 107A****	..	..	..	x	..	..	..
ICC 108	..	..	..	..	..	..	x
ICC 108A	..	..	..	..	..	..	x
USG-A	..	..	x	..	..	..	..
USG-B	..	..	x	..	..	..	..
USG-C	..	..	x	..	..	..	..

Note 1: Tank cars equipped with A.R.A. II and A.R.A. III containers and appurtenances originally designed or subsequently reconstructed to comply with the requirements of ICC 103A cars.

Note 2: Specification A.R.A. IV and ICC 104 tank cars converted in accordance with Note 15, Section 303(q) (1) of the ICC regulations and stenciled, "For Liquefied Petroleum Gas Exceeding 65 Lb. Gage Pressure at 105° F. Only."

No. 215 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

TABLE 1—TANK CARS FOR REFINERY COMMODITIES*

A—Car commonly used.
B—May be used.
D—May be used provided flash point is over 80° F.
C—Commonly used depending on vapor pressure. See Section 110(c) of H. A. Campbell's Freight Tariff No. 4 and Supplements thereto.

Material—	ICC reg. sect.	Service	ICC class of car 103	103A	104	104A	105A	106A	107A	A.A.R. class of car 203
Ammonia, anhydrous	303	N.G.					A	A		
Ammonia, aqua		N.R.	A	A						B
Asphalt (asphaltum)	116	I.L.	C		C					D
Benzene, Benzol, Benzine	110	I.L.	C		C					
Boiler cleansing, preserving, scale preventing or scale removing compound		C.L.	C	C						D
Butadiene	303	I.G.				A	B	B		
Cleaning fluid or liquid or compound	110	I.L.	C		C					D
Compounds, lacquer, paint or varnish, etc., removing, reducing, or thinning, liquid	113	I.L.	C		C					D
Compounds, tree or weed killing	349	P.B.	C							D
Compounds, type-cleaning liquid	110	I.L.	C		C					D
Crude oil, petroleum	110	I.L.	C		C					D
Cyclopentane and methyl cyclopentane	110	I.L.	C		C					
Dichlorethyl ether		N.R.	A							B
Dichloromethane (methylene chloride)		N.R.	A							B
Dichloropentanes		N.R.	A							B
Diethylamine	110	I.L.	C		C					
Diethylene glycol (butyl carbitol)		N.R.	A							B
Dipropylene glycol		N.R.	A							B
Distillate	110	I.L.	C		C					D
Ethylene glycol (butyl "Cellosolve")		N.R.	A							B
Furfural		N.R.	A							B
Gas drips, hydrocarbon	110	I.L.	C		C					D
Gasoline	110	I.L.	C		C					
Gasoline preservative		N.R.	A							B
Grease (not otherwise specified)		N.R.	A							B
Heptane or hexane	110	I.L.	C		C					
Hydrocarbon gas, liquefied	303	I.G.				A	A	A		
Hydrocarbon gas, nonliquefied	303	I.G.							A	
Hydrofluoric acid, anhydrous	264	C.L.					A-500#			
Isobutyl alcohol, isopropanol	110	I.L.	C		C					D
Isooctane, isooctene, isopentane, isoprene	110	I.L.	C		C					
Lacquer, lacquer base, liquid	113	I.L.	C		C					D
Liquefied petroleum gas, maximum pressure:										
375 psi. at 130° F.	303	I.G.						A		
450 psi. at 105° F.	303	I.G.					A-600#			
375 psi. at 105° F.	303	I.G.					A-500#	B		
300 psi. at 105° F.	303	I.G.					A-400#	B		
225 psi. at 105° F.	303	I.G.					A	B		
75 psi. at 105° F.	303	I.G.				A	B	B		
Litharge, wet with water		N.R.	A							B
Methyl isobutyl ketone	110	I.L.	C		C					D
Motor fuel and solvent (n.o.s.), naphtha, naphtha distillate	110	I.L.	C		C					D
Naphtha, solvent	110	I.L.	C		C					
Naphthenic acids		N.R.	A							B
Neohexane	110	I.L.	C		C					
Paraffin		N.R.	A							B
Pentane, methyl pentane	110	I.L.	C		C					
Petroleum ether	110	I.L.	C		C					
Petroleum tar	110	I.L.	C		C					D
Propyl alcohol	110	I.L.	C		C					D
Propylene glycol		N.R.	A							B
Road asphalt, liquid	116	I.L.	C		C					D
Styrene		N.R.	A							B
Sulfuric acid, 52 Be. or stronger	272	C.L.		A						
Tetraethyl lead	347	P.B.					A			
Toluene (toluol)	110	I.L.	C		C					
Turpentine substitutes	110	I.L.	A							D
Waxes (not otherwise specified)		N.R.	A							B
Xylol (xylene)	110	I.L.	C		C					D

*The list of commodities covers tank cars made under ICC and A.A.R. Shipping Container Specifications now in effect. See Section 31 of H. A. Campbell's Freight Tariff No. 4 and Supplements.

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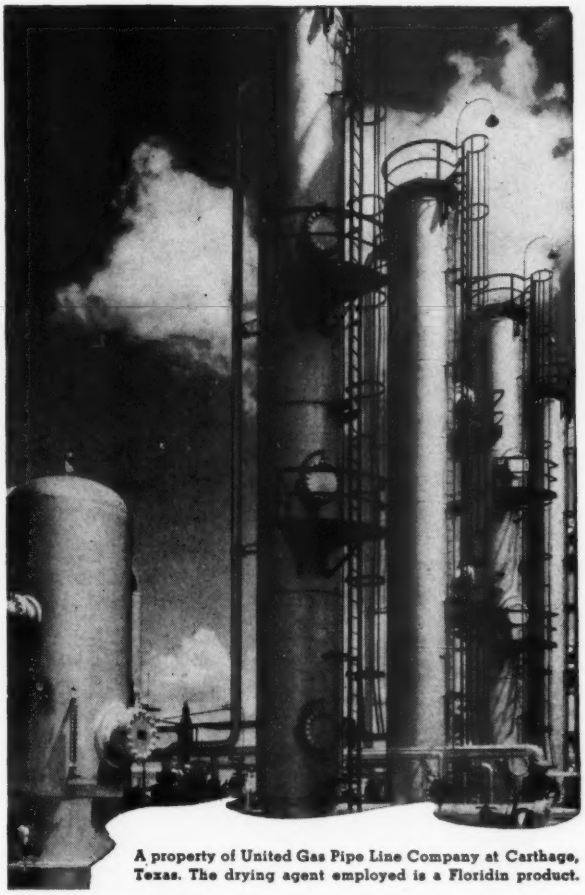

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LEFT: Actual field photograph at 1/250 of a second showing how rapidly Vitron glass fiber underground pipewrap is saturated by the coating permeating the jackstraw arrangement of the fibers.

Vitron*

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PIPE LINES

More Texas Gas Approved For California by FPC

AUTHORITY to loop the El Paso line to carry an additional 100,000,000 cu. ft. daily of Texas natural gas to Southern California has been granted by the Federal Power Commission to El Paso Natural Gas Co., Southern California Natural Gas Co., and Southern Counties Gas Co. of California.

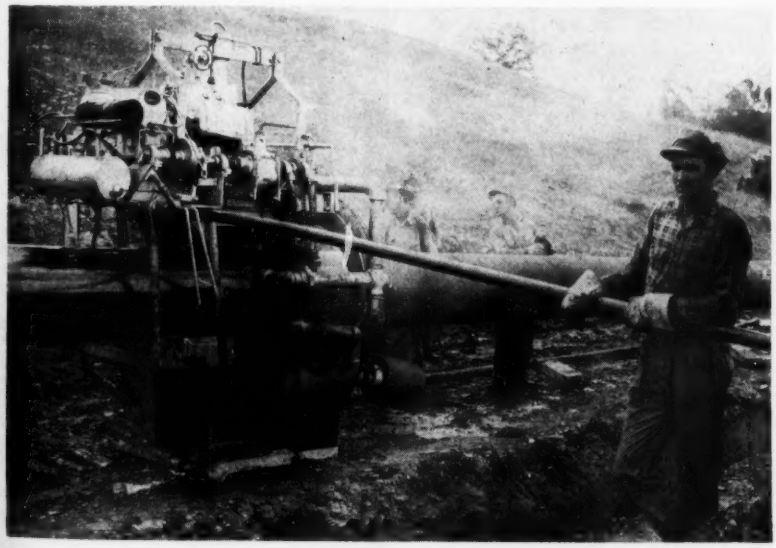
Construction of the authorized facilities will increase El Paso's daily delivery capacity from 166,000,000 to 246,000,000 cu. ft. of gas in Texas, New Mexico and Arizona; from 305,000,000 to 405,000,000 cu. ft. daily at the California-Arizona boundary for delivery to the Southern California companies; and will permit the sale, for a 3-year period, of 17,000,000 to 31,000,000 cu. ft. per day to the West Texas Gas Co. The additional gas available in Arizona permits service to the cities of Yuma and Nogales.

El Paso expects to begin construction of the facilities immediately and to complete them by October 1, 1951. Deliveries of the 80,000,000 cu. ft. daily in Arizona, New Mexico, and Texas would commence not later than January 1, 1950, the company told the commission.

The facilities authorized include approximately 450 miles of 30-in. transmission loop line paralleling a portion of the present 26-in. pipe line from Lea County, New Mexico, to the Colorado River near Blythe; compressor facilities with an aggregate of 70,900 hp.; additional branch transmission lines, gathering lines, and appurtenant facilities. Cost of the project is expected to approximate $56,000,000.

The Southern California companies were authorized to construct and operate approximately 88 miles of 30-in. pipe line to loop in part the existing pipe line from the California-Arizona boundary near Blythe to the Los Angeles area; to build about 15 miles of 30-in. pipe line extending from a point on the Texas-to-California line near Rivira, Calif., to an existing measuring and regulating station in Los Angeles; and to add units totaling 4,000 hp. to its compressor facilities.

Cost has been estimated at $10,040,000. The construction would increase the capacity of the two companies' Los Angeles line from 305,000,000 to 405,000,000 cu. ft. daily in order that they can transport to their markets the additional 100,000,000 cu. ft. daily to be received from El Paso near Blythe. The California companies expect to complete construction so that deliveries can be commenced not later than October 1951.



Dope machine equipped with special rubber tread equipment to prevent scarring pipe in operation in the construction of 40 miles of 20-in. for Ohio Fuel Gas Co. in the Belleville, Ohio, area contracted by Midwestern Constructors, Inc.

CRC

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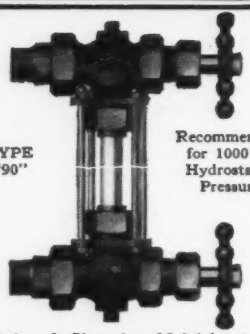

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El Paso Will Start New Looping Project Shortly

THE first 40 miles of pipe to be laid for the 450-mile, 30-in. looping program of El Paso Natural Gas Co., just authorized by the Federal Power Commission, will be started this year. The entire looping program involves laying of this 30-in. between Eunice, N. M., and Blythe, Calif., for expanding capacity of the existing 740 miles, 26-in. trunk line laid in 1947.

Construction on this first 40-mile loop of 30-in. will be under way soon near Deming, N. M. Following the laying of the looping near Deming, the company will lay pipe for the looping program near El Paso, Tex. Later there will be loop construction near Guadalupe, N. M. All construction of these loops is to be handled by spreads operated by El Paso Natural. Pipe for the first 40-mile loop will come from Consolidated Steel Corp. and Republic Steel Corp.

In connection with the expansion program for increasing throughput to Blythe, El Paso Natural has been installing a total of 33,000 hp. compressor equipment at existing stations this year which will make it possible to increase deliveries by an additional 40,000,000 cu. ft. by January 1, 1949.

El Paso Natural spreads have laid 150 miles of 24-in. this year for the Eunice, N. M.-Dumas, Tex., 257-mile extension of the system delivering to California; it is expected that the remainder of this project will be finished December 15. The company's 45-mile, 30-in. line in the Jal, N. M., area and its 25-mile, 16-in. and 18-in., Jal-Kermit, Tex., line have been finished in recent weeks.

Two El Paso Natural spreads are working to complete the 270-mile, 4-in., 5-in., 6-in., 8-in. and 10-in. system in the Fort Huchuaca-Nogales, Ariz., area so that it may be ready to use in October. Already 115 miles had been laid for this particular project early this week.

Three Firms Ask Authority To Build, Buy Gas Facilities

Manufacturers Light & Heat Co., Home Gas Co., and Natural Gas Co. of West Virginia, members of the Pittsburgh Group of Columbia Gas System, Inc., have filed a joint application with the Federal Power Commission for authority to build and buy additional facilities in order to receive additional quantities of natural gas.

Cost of the proposed project has been estimated at $963,863. Facilities to be built by Manufacturers Light & Heat include 10½ miles of 12-in. pipe line from a point near Canons-

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burg, Pa., to near Pittsburgh, and 5 miles of 6-in. line from near Steubenville to Winterville, Ohio.

Home Gas proposes to buy the Dundee compressor stations and storage field in Yates and Schuyler counties, New York, from Keystone Gas Co., Inc.

Natural Gas of West Virginia would build about 5 miles of 8-in. line from Brinker compressor station to near Salem Township, Ohio.

T.G.T. Revises Upward its Expansion Cost Estimate

Cost of the current expansion program of Tennesse Gas Transmission originally estimated at $112,000,000, is being revised upward due to rising material and labor costs.

The company revealed it might have to change the figure in announcing plans for issuing $2,000,000 in common stock.

The company is increasing the capacity of its system from 410,000,000 cu. ft. to 660,000,000 cu. ft. It hopes to increase its delivery to 600,000,000 by the end of this year. The company now has pending before the Federal Power Commission an application for authority to further increase by the end of 1951 the capacity to 1,060,000,000 cu. ft. daily.

Texas Pipe Line Awards Contract for Crude Line

HOUSTON.—Texas Pipe Line Co. has announced award of a contract to Carl H. Dunn, Fort Worth, for the construction of 21½ miles of 10¾-in. crude oil line from Wilson Ranch station in Archer County, to the Wichita Falls station.

Work on the line is scheduled to be started soon after October 1, according to R. B. McLaughlin, president of the pipe-line company .

The Wilson Ranch - Wichita Falls line will operate as a gravity line bringing crude originating in Archer County fields into the new Jal, N. M.-Cushing, Okla., system being built by The Texas Pipe Line Co. The last section of the Jal-Cushing line, that from Wichita Falls to Cushing, is now under construction by Smith Contracting Co., Fort Worth, and is due for completion next February.

Panhandle Eastern Cuts Gas Deliveries in Indiana

Notice of a 50 per cent curtailment of gas deliveries in Indiana has been sent out by Panhandle Eastern Pipe Line Co.

The company said the curtailment was necessary in order to cope with a critical shortage in Michigan. Indiana Governor Ralph Gates said the rationing would mean partial shutdown of about 15 major Indiana industries.

In Harvey, Louisiana . . .

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The Harvey, Louisiana, plant of Pipe Line Service Corporation serves the Gulf Coast area in providing complete facilities for pipe cleaning, priming, coating and wrapping, as well as for reconditioning used pipe. Covering 18 acres on the Intra-Coastal Canal across the Mississippi from New Orleans, this modern plant has adequate storage space and facilities for handling water, rail or truck shipments. Barge shipments can be made direct from the tube mills and coated pipe re-shipped by barge or rail to points on the Gulf Coast or overseas.

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TO PROVIDE more effective coverage, better service and additional technical assistance in the use of hard-facing alloys, Stoody Company announces certain changes in its distributor organization. The accompanying list contains the names of principal distributors throughout the United States and Canada.

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San Diego, VICTOR EQUIPMENT COMPANY
San Francisco, VICTOR EQUIPMENT COMPANY
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Durango, WESTERN OXYGEN COMPANY
Grand Junction, THE DENVER OXYGEN COMPANY
Pueblo, WESTERN OXYGEN COMPANY
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Jacksonville, DUVALL WELDING SUPPLY COMPANY
Miami, MIAMI WELDING SUPPLY, INC.
Tampa, GENERAL ENGINEERING & MACH. CO., INC.
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Billings, MONTANA STEEL & SUPPLY COMPANY
Great Falls, MONTANA STEEL & SUPPLY COMPANY
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Omaha, THE BALBACH COMPANY
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Albuquerque, INDUSTRIAL SUPPLY COMPANY
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OHIO
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Oklahoma City, CLOVIS GEE SUPPLY COMPANY
OREGON
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Pittsburgh, OREWELD, INC.
Wilkes Barre, COMMERCIAL GAS CORPORATION
York, SOUTHERN OXYGEN COMPANY, INC.
SOUTH DAKOTA
Aberdeen, PARSONS WELDING SUPPLY CO.

TENNESSEE
Kingsport, SOUTHERN OXYGEN COMPANY, INC.
Knoxville, SOUTHERN OXYGEN COMPANY, INC.
Memphis, DELTA OXYGEN COMPANY, INC.
TEXAS
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Corpus Christi, MAGNOLIA AIRCO GAS PRODUCTS CO.
Dallas, MAGNOLIA AIRCO GAS PRODUCTS CO.
El Paso, MAGNOLIA AIRCO GAS PRODUCTS CO.
Fort Worth, MAGNOLIA AIRCO GAS PRODUCTS CO.
Houston, MAGNOLIA AIRCO GAS PRODUCTS CO.
Kilgore, BRAMBLETT & ALLEN WELDING SUPPLY
Lubbock, WEST TEXAS OXYGEN COMPANY
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San Antonio, MAGNOLIA AIRCO GAS PRODUCTS CO.
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UTAH
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Among the

Drilling Contractors

Keating Promotes Two

Keating Drilling Co. has announced that Paul W. Randels of Fort Worth has been named vice president of the company, and will make his headquarters in Fort Worth. At the same time it was announced that John E. McKinney, Tulsa, was elected secretary. He will be headquartered in Tulsa. Randels was formerly manager of Black, Sivalls & Bryson. He joined the Keating company in January of this year. McKinney has been associated with Keating for some time.

Iron Drilling Co. has been awarded contract on the Darby & Bothwell 1 McDowell, a rank wildcat in NW NW NE 36-11-30, Gove County, Kansas, approximately 40 miles southwest of Studely pool of Sheridan County. Wilcox Oil Co. has an interest in the venture. Magnolia Petroleum Co. is providing dry-hole support and Atlantic Refining Co. bought a spread near the location.

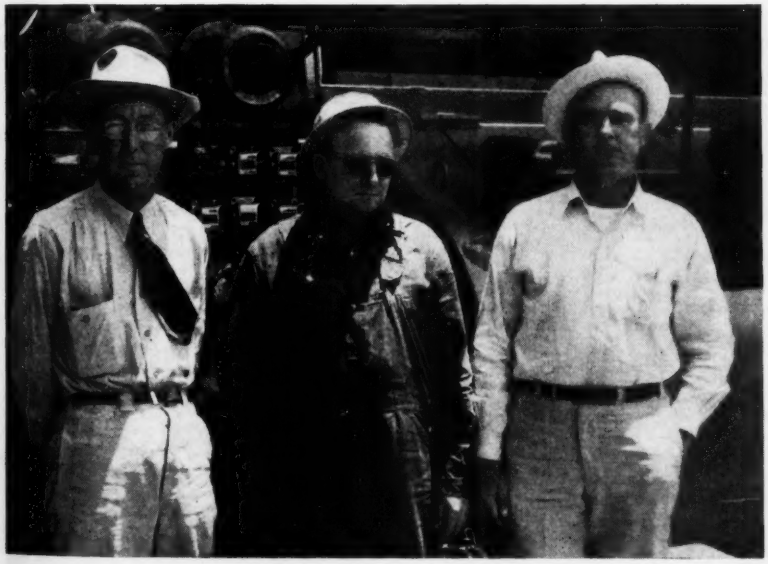
Foster Drilling Co., Cushing, Okla., will drill the 1 Allena, a 4,300-ft. wildcat in NE NE SW 25-20n-4e, northern Payne County, Oklahoma. The operation will test a block recently assembled by George B. Merry and E. A. Gould.

Circle Drilling Co. will drill two wells in Richie field, Acadia Parish, Louisiana, for Bates & Cornell. The tests are The Maccabees et al A-3 A-B-M and A-3, both in 20-7s-1w. Contract depths are not reported.

Noble Drilling Co. will drill 1 La-Terre Co., Inc., for Stanolind Oil & Gas Co. in SW 12-20s-20e, Terrebonne Parish, Louisiana, approximately 4 miles west-southwest of Golden Meadow field in Lafourche Parish. Contract depth is 13,500 ft.

D. Thomason Drilling Co. will drill a 6,500-ft. wildcat for M. B. Chastain, Shreveport, in Panola County, East Texas. The project is to be the 1 Riggs, in the J. F. Needham Survey, 5 miles southwest of Deadwood, and about 1 mile south of Skelly Oil Co. 1 Werner-Geneva. Location is on a 6,000-acre farmout from Continental Oil Co., and carries a provision for continuous drilling if the first well is a producer.

Gilger Drilling Co. will drill Joe W. Brown 3 Valentine, in Valentine pool



T. A. Van Ness (left), drilling superintendent, and T. R. Allison (right), petroleum engineer, Bayou Sale district, Humble Oil & Refining Co., with J. S. Daniel, driller, on one of this company's drilling rigs in Weeks Island field, Iberia Parish, South Louisiana

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For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

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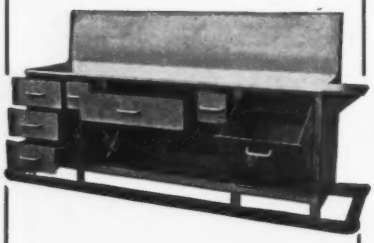

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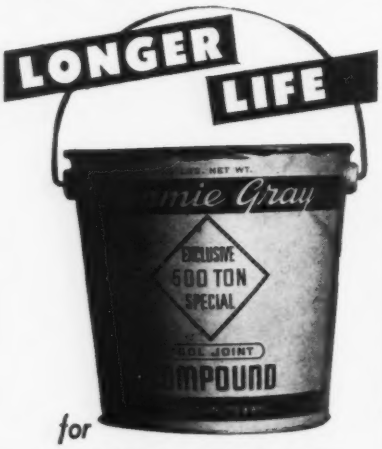

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of Lafourche Parish, Louisiana, to 10,000 ft. Well is in 100-17s-20e.

Bankhead Drilling Co. has contract to drill A. J. Bankhead 1 Bank of Baton Rouge, in University field, East Baton Rouge Parish, Louisiana, to a depth of 10,000 ft.

Falcon - Seaboard Drilling Co. is starting a 4,300-ft. wildcat in Hughes County, Oklahoma. Test is the 1 Hudley, in NW NE SW 20-6n-10e, and is on a block of approximately 700 acres.

Barnett Drilling Co. is contractor on the Mid-Continent Petroleum Corp. 1 Wafner, in NW NW NE 26-21-15, Pawnee County, Kansas, 4½ miles east of Torrance gas pool and 7½ miles southeast of Ash Creek pool. Sunray Oil Corp. and Champlin Refining Co. are supporting the test, on which 903 ft. of 8-in. surface pipe has been set.

B. & R. Drilling Co. was making hole below 1,000 ft. at the 1 Ross, in SW SW SW 25-22-14w, Stafford County, Kansas, 2 miles southeast of the recently opened Nellie pool and 5 miles southwest of Curtis pool. Lion Oil Co., Sunray Oil Corp., and Sinclair Prairie Oil Co. are supporting.

Virginia Drilling Co. is the contractor on Aladdin Petroleum Co. 1 Reeder, in SE SE NE 22-12-19, Ellis County, Kansas, 6 miles west of Koblitz pool. Test was making hole below 3,200 ft.

At an organizational luncheon held recently in Dallas, local members of the American Association of Oil-Well Drilling Contractors formed the Dallas-Fort Worth Chapter, the tenth district chapter to be organized in the association. Thomas J. Carter, left, of Thomas J. Carter Drilling Co., Dallas, was elected vice chairman and Louis A. Beecherl, McDaniel & Beecherl, Dallas, was elected chairman. Not shown is R. V. Everidge, of Davidson Drilling Co., Fort Worth, new chapter secretary. The next chapter meeting will be held in Dallas October 4

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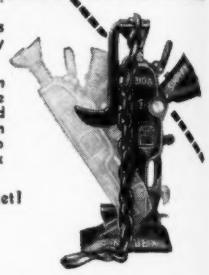
EMERGENCY JACK** MODEL 310-A



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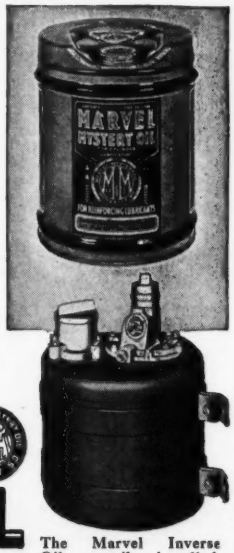

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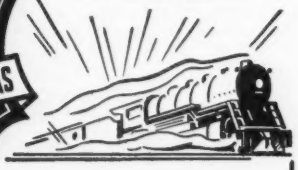

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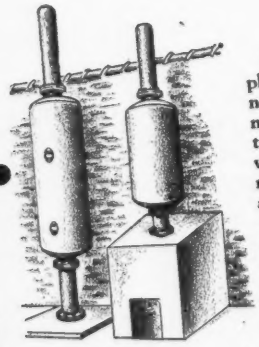

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NATURAL GAS

Propane Called Best Bet To Meet Peak Gas Loads

THE problem of meeting peak winter loads presents a real challenge to the gas industry during the next decade and at present it probably can be met best by stored propane, it was declared by Charles Pennypacker Smith, chief gas dispatcher of Pacific Gas & Electric Co., in addressing the fifty-fifth annual meeting of the Pacific Coast Gas Association in Santa Cruz last week.

New officers of the association elected at the meeting were: president, A. F. Bridge, Southern Counties Gas Co.; vice president, N. Henry Gellert, president, Seattle Gas Co.; treasurer, D. G. Martin, auditor, Pacific Gas & Electric Co.; directors, C. A. Gabriel, president, Monarch Heating Co.; C. H. Gueffroy, vice president, Portland Gas & Coke Co.; W. M. Jacobs, sales manager, Southern California Gas Co.; J. S. Moulton, vice president, Pacific Gas & Electric Co.

A feature of the convention was the award of the association's medal of honor to R. M. Conner, former director of the testing laboratories of American Gas Association and author of the first gas appliance testing code published in 1924.

Standby Facilities Needed

Smith said that the growth of gas customers will make it impossible for gas companies to have reserve capacity to meet peak load requirements, so standby facilities must be provided to take care of days colder than those normally expected in an ordinary winter. He calculated that about five such days are apt to occur in California each year.

Five possible means of supplementing the regular gas supply were described by Smith, and he gave the cost of installed capacity per M.c.f.-day as follows: Oil gas plant, $250.00; storage in 26-in. pipe line, $119.00; storage in high-pressure bottles, $82.00; storage in 26-in. pipe racked above ground, $75.00; propane-air plant, $12.50.

The propane-air plant used in the calculations would have a capacity of 50,000,000 cu. ft. (natural gas equivalent) with storage of 1 day's operation. It would cost $35.50 to provide 5 days' reserve, $64.50 for 10 days' reserve, and $93.50 for 15 days' reserve.

The principal deterent to the use of propane for peak reinforcement has been the shortage of winter supply, Smith admitted, but he calculated that, at least in California, ample raw supplies exist to produce the propane needed for gas companies and he said that the companies could easily arrange to procure and transport the necessary propane during the slack summer season, and this would meet peak-load requirements in the state at least until 1960.

"Beyond 1960, if the base natural gas supply continues to decline," Smith said, "there will be a steady increase in the frequency use of peak-reinforcing facilities, and consequently a rapid growth in the quantity of feed stock required each year, as well as the number of days' reserve which must be maintained.

"If it were possible to use other feed stocks lower in the hydrocarbon series, such as gasoline, the investment in storage tanks would be reduced. Furthermore, there would then exist a possibility of replenishing stocks during a cold winter, which would limit the amount of storage to be maintained.

"It would seem desirable for the gas industry to sponsor research in this direction. It may well be that the cost per M.c.f. capacity would be cut considerably below the $35-level indicated for a 5-day reserve."

Proposed Rate Increase Of Interstate Suspended

A supplemental rate schedule under which Interstate Natural Gas Co., Inc., would increase rates for natural gas sold to Mississippi River Fuel Corp., Texas Gas Transmission Corp., and Southern Natural Gas Co. has been suspended by the Federal Power Commission.

A hearing on the proposed schedule will be held in Washington October 18.

Barnsdall Will Build McFadden Field Plant

HOUSTON.—Barnsdall Oil Co. is preparing to construct a gas compressor plant to handle between 10,000,000 and 12,000,000 cu. ft. daily in McFadden field, Victoria County, Texas.

A pipe line will provide an outlet to Tennessee Gas Transmission Co.'s system near Bloomington. The new compressor plant is expected to be finished in about 7 months.

Natural Gasoline

Chicago Corp. to Finish Gasoline Plant Next Year

HOUSTON.—Construction of a $2,000,000 addition to the natural-gasoline plant of Chicago Corp. in Carthage field, Panola County, Texas, is expected to be completed next summer.

In its semiannual report, the company notes that the Carthage plant addition will increase intake capacity from 125,000,000 cu. ft. to 210,000,000 cu. ft. daily. Present production capacity of the plant, including L.P.G., is listed at 135,000 gal. daily.

Sales of gas by the Oil and Gas Division of Chicago Corp., which has headquarters in Corpus Christi, were somewhat less than anticipated due to the inability of Tennessee Gas Transmission Corp. to take its full contracted amount during the first half of 1948. However, the report said, negotiations are under way with Tennessee Gas for settlement of the contract deficiencies, and if these are concluded, gas-sales earnings should rise moderately.

The report said oil and gas earnings showed an increase of about 42 per cent during the first half of 1948, primarily due to higher prices received. During the period, the company received $805,101 for 16,300,000,000 cu. ft. of gas, $3,938,373 for 1,200,000 bbl. of products, and $1,604,903 for 575,000 bbl. of crude oil and distillate.

The report also said the company had purchased shares in Standard Pipeprotection, Inc., and had a commitment to purchase $500,000 of preferred stock in that company.

Skelly Begins Operation At New Velma Plant

Skelly Oil Co. began operations last week at its new natural-gasoline plant near Velma, in Stephens County, Oklahoma. The plant at peak operations will have a capacity of 30,000,000 cu. ft. per day.

Construction, handled by Born Construction Co., Tulsa, was begun in July 1947.

Dry gas from the plant is being being delivered to Oklahoma Natural Gas Co. through a new line to the company's Healdton plant. Oklahoma Natural has completed about 30 miles of a new trunk system in the area.

The new plant is fed by three gathering systems extending into all sectors of the major Velma district, where Skelly is the major oil-producing company.

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REFINING

Industry Records Big Refining Capacity Gain

TOTAL operating capacity of petroleum refineries in the United States was 6,034,252 bbl. daily at the beginning of 1948, according to the latest annual survey of petroleum refineries and cracking plants issued by the Bureau of Mines.

At the beginning of 1947, the daily crude-oil capacity totaled 5,569,482 bbl. daily.

Total capacity of facilities for producing cracked gasoline at the beginning of this year was 1,514,622 bbl. daily, an increase of 109,526 bbl. daily over the beginning of 1947

The Bureau report was prepared by F. S. Lott, chief of the Petroleum Economics Branch, and includes a summary of refineries by states and districts, changes in crude-oil capacities by districts annually since 1941, a summary of cracking plants, 1924-1948, and cracking plants operating January 1, 1948. In an additional table, cracking capacity is classified by the three principal types, by districts.

Runs Higher

Crude runs to stills in January 1948 averaged 5,348,000 bbl. per day, or 88.6 per cent of the total crude-oil charging capacity of the refining industry at the start of 1947. Daily average crude runs to stills in other recent years totaled 85.1 per cent of capacity in 1947; 85.0 per cent in 1946; 88.3 per cent in 1945; and 75.7 per cent in 1941.

Only part of the 464,770-bbl. increase in rated capacities of petroleum refineries was due to major new construction. Spread over all of the larger refining districts, much of the added production capacity was accomplished by rearrangement and minor additions to existing facilities permitting their more efficient and complete utilization. Construction of new distillation units under way a year ago totaled only 162,200 bbl. daily, compared with 367,250 bbl. daily on January 1, 1948.

Most of the gains in facilities for cracking gasoline were made in the coastal areas and the Indiana-Illinois district. About 75 per cent of the new cracking capacity was of the catalytic type. The rated capacity of additional cracking units reported under construction totaled 80,000 bbl. per day on January 1, 1947, and 172,000 bbl. per day a year later.

Texas, with 80 refineries and one under construction, led other states in the number of installations and also was the leading state in the crude-oil throughput capacity with 1,722,200 bbl. per day. California's 61 refineries had a rated capacity of 1,093,700 bbl. per day; Pennsylvania's 18 refineries had a potential capacity of 446,150 bbl. per day; and Louisiana's 18 refineries, 433,900 bbl. daily.

A free copy of the report, Information Circular 7483, "Petroleum Refineries, Including Cracking Plants, in the United States, January 1, 1948," may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa.

Construction Under Way On Texas Co. Buildings

Construction is now under way on a new office building and an employes building at Eagle Point, N. J., on a 1,300-acre site purchased by The Texas Co. as the site of a new refinery.

Contract for the buildings is held by Turner Construction Co., New York.

Sun Lets Contract for Huge Toledo Project

Contracts for a $16,000,000 expansion program expected to nearly double the capacity of the Toledo refinery of Sun Oil Co. have been let, according to Clarence H. Thayer, vice president in charge of manufacturing.

Catalytic Construction Co., Philadelphia, will build the new processing units.

Included in the program will be the installation of a 42,000-bbl. Houdriflow unit, a catalytic cracking unit incorporating a pneumatic lift for circulating the catalyst. The improved process was developed jointly by Houdry Process Corp. and Sun Oil Co.

Also scheduled for construction are a large gas-recovery and gasoline-stabilization plant, a new polymerization plant, a crude-distillation unit, a vacuum-flash unit, and auxiliary units required by the major installations.

All new units will be integrated with existing installations to increase the over-all efficiency of the refinery, Thayer said.

Process design for the gas-compression unit will be done by Fluor Corp.

Process Engineers, Inc., will design the gas-absorption and gasoline-stabilization unit.

Major construction is scheduled for completion by December 31, 1949.

At present the Toledo refinery has a crude processing capacity of 35,000 bbl. daily and a cracking capacity of 31,000 bbl., including a 14,000-bbl. Houdry catalytic unit.

Pan American to Add Buildings at Texas City

HOUSTON.—Pan American Refining Corp. has awarded contract to H. K. Ferguson Co. of the construction of four new buildings at its Texas City refinery.

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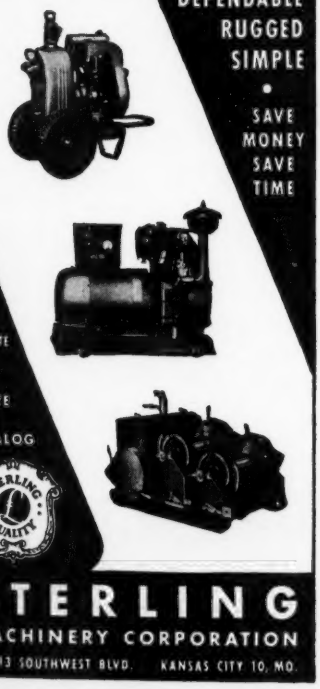

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Plans are for a two-story brick and tile office building, a pilot plant and laboratory addition, a new chemical laboratory, gate house and change house, and the alterations to several existing structures. Cost of the work is estimated at more than $1,000,000.

Indiana Standard to Sell Refinery Gas at Whiting

Standard Oil Co. (Ind.) has signed a 15-year contract with Carbide & Carbon Chemicals Corp. to supply the latter company with hydrocarbon gas from Indiana Standard's Whiting, Ind., refinery.

The gas will be processed in Carbide & Carbon's chemical plant adjacent to the Whiting refinery. Value of the refinery gas contracted for was placed at "approximately $75,000,000."

Indiana Standard officials said an increasing proportion of the gas has been sold to the chemicals company since 1935, for use as a raw material in the production of a variety of chemicals. Under the new agreement, the volume of gas delivered will be "substantially greater" and will permit, they said, "a sizable expansion of the production facilities in the Carbide plant."

Standard's own chemicals program will utilize other liquid and gaseous petroleum fractions at the Whiting refinery as source materials, the company said, adding that the major activities of the company in the chemicals field will be centered in its Wood River, Ill., refinery.

A.P.I. Prints Catalogue Of Refining Training Films

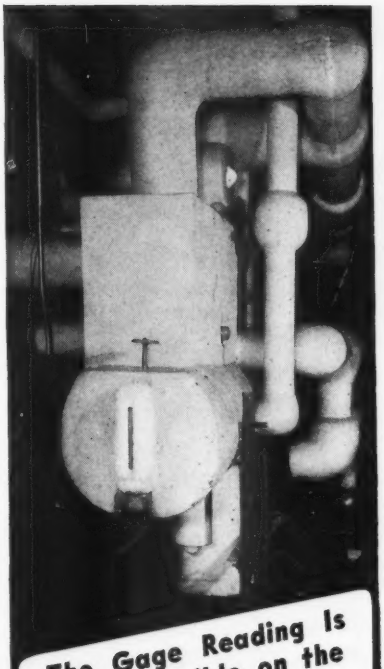
All available films suitable for training in refining operations have been catalogued by the Division of Refining of the American Petroleum Institute. The compilation, printed as a book, lists 1,300 films, giving the title, description, a short review, and the source and terms of availability of each.

The 200-page catalogue may be obtained for $3 from the American Petroleum Institute, 50 West Fiftieth Street, New York 20.

W.P.R.A. Plans Corrosion Roundtable in Chicago

A forum on corrosion problems occasioned by the processing of high-sulfur crude oils will be conducted by the Western Petroleum Refiners Association in Chicago October 14.

The 1-day meeting will be held in the Stevens Hotel. To be conducted as a roundtable discussion, it is designed to provide an opportunity for corrosion engineers, operators, and safety engineers to exchange views on the many problems associated with sour-crude operations.



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Exploration and Drilling

Canada May Have Important Strike

THE eyes of all exploration men interested in Canadian developments are turned toward Imperial Oil Co., Ltd., 1 Redwater, LSD 1 (SESE) 32-57-21w4th (Section 32 is equivalent to Section 5 in United States system). This wildcat looks like a new field opener in the Devonian pay, and is located some 40 miles north and a little east of Leduc field.

First rumors had it that this well had made a large flow of oil on drill-stem test from the Devonian pay at 3,111-31 ft. Imperial discounted these reports, but admitted a favorable indication. It was good enough to justify setting pipe, and further coring. Late reports indicate 83 ft. of pay has been found and no sign of the water level yet. Gravity of oil is reported to be 35°.

This well is about midway between Leduc and the new exploration play in northern Alberta that may be said to have the town of Athabaska as a southern starting point. If it lives up to expectations, it makes the new plays only half as much of a stepout as they looked when first started.

The pay in the new test is more than 2,000 ft. shallower than at Leduc, although it is probably equivalent geologically. This is due to the fact that it lies up the regional dip in the Alberta syncline toward the pre-Cambrian granite shield against which all sedimentary rocks pinch out. At Leduc, the Devonian pay is around 5,400 ft., against the 3,100-3,200 ft. now being tested at Redwater.

This is encouraging in that it appears to prove that the Devonian will produce with far less thickness cover of younger rocks than at Leduc. Previously there appeared to be no apparent reason why the shallower portions of the regional syncline should not have Devonian production. But there was always a possibility that something would show up to limit the Devonian possibilities to deeper areas. Production at Redwater would widen the territory where Devonian production was proven possible. It would take into the possible area everything toward the granite shield with at least to 3,000 ft. of cover, insofar as any limiting conditions due to sedimentary cover are concerned.

It is interesting to note that Amerada Petroleum Corp. only recently completed a stratigraphic-test slim hole just 12½ miles east and 1½ miles south of the Redwater. This "strat" test, the 1 Skare, was in NW NW 21-19-21w4th (equivalent to United States Section 16), and announced as drilled to 2,825 ft., total depth.

Amerada, which has about 300,000 acres under reservation, in three blocks, is apparently trying something new (for Canada) in exploration economics. Using slim-hole drilling rigs, it is drilling a strat test in every township, thus spacing its holes 6 miles apart. With four rigs running, it has averaged about one completed hole per month per rig. Some have been drilled in far less time; one took as long as 63 days. The depths have ranged from 2,058 to 3,425 ft. Presumably all went to the Devonian (or at least some Paleozoic marker).

The strat tests obviously give close regional subsurface control. They probably cost much more than gravity work would, but yield more detailed information. Furthermore, the information they yield, and the controls afforded, should cut down the amount of seismic work required, while increasing the accuracy of seismic interpretation.

It will be interesting to see if the over-all economics of this plan work out sufficiently to encourage expansin of the technique. Obviously it has its most advantageous area where the Devonian is not too deep.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

WEST TEXAS.—Pennsylvanian production in the Permian Basin continues to gain in relative importance of future reserves. This week all attention was focused on northern Upton County, where Magnolia Petroleum Co. 1-A TXL had flowing oil from the Pennsylvanian at 10,195-10,112 ft. After the test, operators cored additional lime pay. Previously, a section from 9,321-9,345 ft., also in the Pennsylvanian, showed for production. Location of the wildcat is 20 miles from the nearest field.

NORTH TEXAS.—Standard-Fryer Drilling Co. 1 Morris had oil from the conglomerate on a drill-stem test at 5,173-81 ft. Reports said it flowed at the rate of about 10 bbl. an hour when the packer failed. Successful completion would extend the Chicago field of Wise County 4,000 ft. to the southwest.

SOUTHWEST TEXAS.—A new important Wilcox zone discovery well in northern Duval County, 1¼ miles northeast of the Eagle Hill field, is being completed at Atlantic Refining Co. 1 Hagist, BS&F Survey 267. Production is through perforations at 9,634-60 ft.

ROCKY MOUNTAIN.—Shows of oil have been reported in Equity Oil Co. of Salt Lake City's wildcat on the Ashley Valley structure, northwest of Rangely, Colorado. The well encountered shows of oil in the top of the Weber and casing is now being run for tests. Shows of oil have also been reported in Clark Drilling Co.'s wildcat at Fiddler Creek, Weston County, Wyoming, and tests are now being made.

CALIFORNIA.—Barnsdall Oil Co. made successful water shut-off at its prospective Guijarral Hills discovery, the 1 Smith in 34-20s-16e, Fresno County. The well is reported to have produced at the daily rate of 5,300 bbl. of 33.6°-gravity oil during a test of the Leda zone (Oligocene) which is believed to be a pinch-out sand in this area.

TEXAS GULF COAST

Harris County Gets New Discovery

HOUSTON.—A new oil discovery in North Harris County has been completed at Lamar Hunt Trust Estate 1 E. L. Kuhlman, in the Fred Limsky Survey, Abstract 512, being 1¼ miles northwest of Spring townsite. Drilled to 7,314 ft., with top of pay at 5,875 ft. The well flowed 41.25 bbl. of 38°-gravity oil per day through a 5/32-in. choke, with flowing pressure on tubing 250 psi. Gas-oil ratio 550, no water in the flow.

Humble Oil & Refining Co. 1 Thompson Brothers Mineral Corp. et al, a new gas-condensate discovery for Trinity County, through a 5/16-in. choke it flowed 90 bbl. of fluid, 60 per cent being 57.8°-gravity condensate and 40 per cent being brackish water, along with 3,500,000 cu. ft. of gas daily. Flowing pressure on tubing was 2,000 psi. Total depth is 12,005 ft., with production casing cemented to 11,939 ft. Production is through perforations at 10,246-10,370 ft. in the upper portion of the Washita lime.

A new producing zone for North Beech Creek field in Hardin County has been opened by American Republics Corp. 4 Olive Sternenberg & Co., flowing 92 bbl. of 43.1° gravity through a ⅛-in. choke, flowing pressure on tubing 1,675 psi. Gas-oil ratio 4,098. Total depth 6,299 ft., with plugged back depth at 6,215 ft. Production is through perforations at 6,212-6,213 ft.

Southern Minerals Corp. 1 Perryman, wildcat discovery prospect, in Refugio County, in J. de La Garza Trudo Survey, perforated at 7,114-17 ft. and ran production test for completion attempt at that level, after setting 5½-in. casing to 7,141 ft. Total depth is 7,175 ft. On drill-stem test at 6,449-55 ft., prior to setting casing, the well had shown for gas production with spray of condensate.

Lloyd H. Smith Exploration Co. 1 San Jacinto River, an oil well directionally drilled under the San Jacinto River on the north flank of the Humble Dome in Harris County, was drilled to 4,880 ft. and on 24-hour flow gage, the well made 132 bbl. of 18.3°-gravity oil per day through a 12/64-in. choke. Flowing pressure on tubing 240 psi., casing pressure at 450 psi. Gas-oil ratio 250. Production is through perforations at 4,178-92 ft. and 4,203-18 ft.

A total of 47 new locations were reported for Districts 2 and 3, with 9 being wildcat starts, 2 in Brazoria, and 1 each in Austin, Calhoun, Chambers, Galveston, Harris, Jefferson and Newton counties. Four successful exploratory tests were completed, one each in Goliad, Hardin, Harris, and Live Oak counties. Fourteen wildcat failures were reported, three in San Jacinto, two each in Jefferson and Wharton, and one each in Harris, Jackson, Liberty, Matagorda, Montgomery, Newton and Wilson counties.

TEXAS GULF COAST (DISTRICTS 2 & 3) SUCCESSFUL WILDCATS

Goliad County: New gas pay, Gottschalt field—W. L. Goldston 2 Mary Meyer, in Luke de Mott Sur., ½ mi. SW of Weesatche townsite, top pay 7,316 ft., Reklaw sd., TD 7,705 ft., perf. 7,316-7,324 ft., IP: 1,500,000 cu. ft. gas per day through ⅛-in. choke, gas-condensate ratio 100,000, shut-in pressure 3,000 psi., no water.

Hardin County: New oil sand, North Beech Creek field—American Republic Corp. 4 Olive Sternenberg & Co., John Taylor Sur., TD 7,336 ft., plugged back TD 6,215 ft., top sand 6,199 ft., perf. 6,212-13 ft., IP: 92 bbl. oil per day through ⅛-in. choke, GOR 4,098, TP 1,675 psi., 43.1° gravity, 5.5 per cent water.

Harris County: New oil discovery—Lamar Hunt Trust, Estate 1 E. L. Kuhlman, in Fred Limsky Sur., A-512, 1¼ mi. NW of Spring townsite and approx. 8,500 ft. northwest of Spring field production, TD 7,314 ft., top sand 5,875 ft., perf. 5,875-79 ft., IP: 41 bbl. oil per day through 5/32-in. choke, GOR 550, TP 250 psi., gravity 38°, no water.

Live Oak County: New gas-condensate pool Western Natural Gas Co. 1 Clayton, Dr. C. F. Simmons Subd. of D. R. Fant, Jr., Sur., 248, 10 mi. W of Geo. West and 6 mi. SW of Kittie West field, top pay 6,960 ft. Massive Wilcox, TD 7,150 ft., perf. 6,985-95 ft., IP: 100,000,000 cu. ft. gas per day open flow, gas-condensate ratio 44,000, flowed 70 bbl. per day condensate and 2,800,000 cu. ft. gas per day through a ¼-in. choke, TP 2,355 psi., CP 2,500 psi., shut-in pressure 2,550 psi., no water.

TEXAS GULF COAST (DISTRICTS 2 & 3) WILDCAT FAILURES

Harris County: Gulf Oil Corp. 1 E. G. Siadous, Wm. J. Lovett Sur., North flank of Mykawa dome, dry, TD 10,500 ft.

Jackson County: Belgam Oil Co. 1 Mary Sheblak, in Thomas Menefee Sur., A-52, 5 m. SW of Ganado, dry, TD 5,515 ft.

Jefferson County: Jas. F. Morse & Co. 1 Mrs. M. Clampitt, in A. Savery League, off southwest side of West Beaumont field production, dry, TD 7,755 ft.

Brown & Wheeler 1 S. W. Pipkin Est., T&NO Sec. 178, A-636, 2½ mi. SE of Stowell townsite, 1 mi. S of Stowell field prodn., dry, TD 10,014 ft.

Liberty County: Miles Prodn. Co. 1 Zoe MacDonald et al, in James Eldridge Sur. A-182, 1¼ mi. SW of Cleveland field production, dry, TD 6,264 ft.

Matagorda County: Arkansas Fuel Oil Co. 1 J. J. LeTulle, in I&GN Sec. 2, 9 mi. SE of Wadsworth townsite, dry, TD 6,412 ft.

Montgomery County: W. F. Newton 1 E. I. Conroe, in W. M. Conroe Subdn., of J. G. Smith Sur., 3 mi. E of Conroe, dry, TD 5,184 ft.

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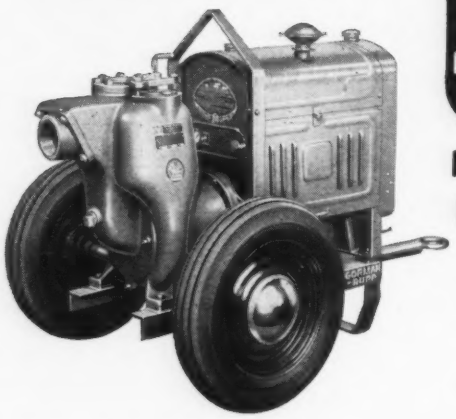

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Newton County: Humble O. & R. Co. 1 C. A. Dyer et al, HT&B Sur. A-189, 3.8 mi. NE of Gist townsite, dry, TD 7,503 ft.

San Jacinto County: Gulf Oil Corp. A-1 Foster Lumber Co. et al, in P. Whitaker Sur. A-598, 2 mi. NW of Fosteria, dry, TD 10,500 ft.

Thomas O. & G. Co. 1 Carey, Haley & Manning Lbr. Co., in Isaac Jones Sur., 7 mi. SE of Point Blank townsite, dry, TD 7,523 ft.

Ernest Adams & J. C. Means, Jr., 1 Ross Tract, in Solomon Cole Sur., A-84, 1½ mi. SW of Shepherd, dry, TD 5,013 ft.

Wharton County: Hankamer Inv. Co. 1 Thomas Martinets, in ETRR Sec. 47, 5 mi. SE of El Campo, dry, TD 7,540 ft.

W. B. Jayred 1 Edwin Hawes, Jr., et al, in S. Castleman Sur. 4, 7½ mi. S SE of Wharton townsite, dry, TD 5,600 ft.

Wilson County: Humble O. & R. Co. 1 N. A. Poth, in Don Caspar Flores Grant, 10½ mi. SW of Poth and near Karnes County line, dry, TD 6,100 ft.

CALIFORNIA

Guijarral Hills Well To Be Tested Soon

LOS ANGELES.—Barnsdall Oil Co. has announced that water shut-off has been made successfully at its new discovery in the Guijarral Hills area of Fresno County, the 1 Fred Smith, 34-20s-16e, and that production tests are scheduled to get under way early in the week to determine the well's true productive capacity. The official announcement also stated that the Leda oil sand, topped at 8,658 ft., actually produced at the rate of 5,300 bbl. daily during an 18-minute formation test with packer set at 8,700 ft. The test, made through an ⅜-in. choke, showed gas in 11 minutes. Gravity of the oil was reported to be 33.6°., and water cut was reported at 0.1 per cent.

The 1 Fred Smith is located on a downdip of the Pleasant Valley field structure toward the Kettleman Hills field. Only a few miles separates these two fields. The Leda zone, which is a member of the Oligocene formation, is believed to be a pinchout sand in this particular spot.

Standard Oil Co. of California expects to go to at least 5,000 ft. with its wildcat on Ortega Hill in the Summerland area of Santa Barbara County unless substantial production is developed at a lesser depth, it has been announced. The venture, known as the 1 Williams, 16-4n-26w, is reported to have produced at the rate of 3,000 cu. ft. of gas daily on a formation test at the depth 3,080-3,100 ft. The well is now coring and drilling ahead at 3,300 ft. Nearly 50 years ago the first tideland wells were developed in California in the Summerland field. Subsequently many producing wells were completed and abandoned until now there are only a few producing wells in the field. The area has never been tested to a very great depth, however, and Standard is the first to inaugurate such a venture.

Marine Exploration Co. apparently has been swabbing a small amount of oil from its 2 State, 11-5s-12w, a tidelands test in the Seal Beach area of Los Angeles County. This well, which has reached a total depth of 11,900 ft., is believed to be testing in the Terminal or Ford zone. While the vertical depth of this well appears to be great, the actual depth is only approximately 4,000 ft. The other 7,900 ft. is horizontal depth achieved by whipstocking the well out beneath the tidelands at Seal Beach. Even if this well should prove to be of no commercial value, it will have been a step forward in the advancement in directional drilling, since it has reached angles as high as 55° off vertical to achieve the title of the "most off-vertical hole" ever drilled.

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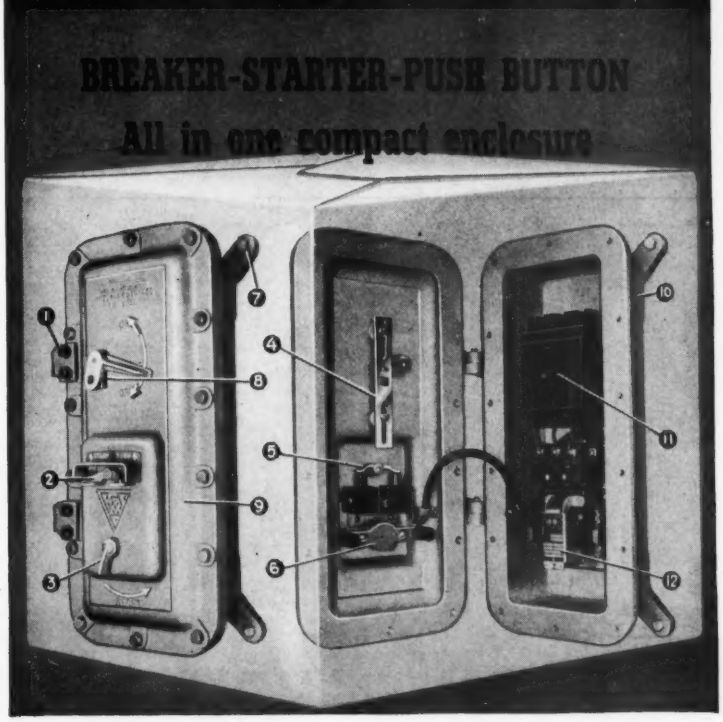

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siderable interest among California operators by staking location for the 1 Hughes, 30-23s-22e, a gas test in Kings County. This drill site is approximately ½ mile north and ½ mile west of the company's 1 Cutter Unit, a gas field discovery drilled 4 years ago which came in flowing from the depth 3,480-3,505 ft.

CALIFORNIA SUCCESSFUL WILDCAT

San Benito County, Ciervo area: The Texas Co. 1 Ashurst NCT One, 27-16s-11e, pumped 8 bbl. daily, 15.3° gravity, water cut 2.3 per cent, top Paleocene 703 ft., TD 1,688 ft.

CALIFORNIA WILDCAT FAILURES

Kern County, Comanche Point area: Tejon Hills Oil Co. 6 Tejon Hills, 10-11n-18w, dry, elev. 1,277 ft., TD 1,688 ft.

Edison area: Seaboard Oil Co. 1 Porter, 28-30s-29e, dry, elev. 466 ft., TD 5,163 ft.

McKittrick area: General Petroleum Corp. 62-9 Ninkovitch, 9-30s-21e, dry, elev. 1,863 ft., Phacoides 9,560 ft., Oceanic 10,052 ft., Point of Rocks 10,585 ft., TD 11,283 ft.

Signal Oil & Gas Co. 2 Signal-Pike, 10-30s-22e, dry, elev. 750 ft., TD 6,246 ft.

Rosedale area: Continental Oil Co. P-1 K.C.L., 11-29s-26e, dry, elev. 365 ft., Vedder sand gray, Rio Bravo 9,696 ft., Vedder 9,745 ft., TD 9,788 ft.

Tejon Ranch area: Richfield Oil Corp. 1-10 Tejon D, 10-11n-18w, dry in gray sand, elev. 1,102 ft., TD 1,202 ft.

Williams area: British-American Oil Producing Co. 33-28 U.S.L., 28-27s-19e, dry in gray sand, elev. 980 ft., TD 2,722 ft.

Kings County, Pyramid Hills area: Tanksley & Southard 2 Avenal, 15-24s-17e, dry, elev. 963 ft., TD 1,210 ft.

Monterey County, Salinas Valley area: The Texas Co. 1 Echeberria One, 33-21s-11e, dry, elev. 843 ft., TD 2,262 ft.

Santa Barbara County, Cuyama Valley area: Richfield Oil Corp. A-147-5 Russell, 5-10n-27w, dry, elev. 2,081 ft., TD 1,952 ft.

San Luis Obispo County, Parkwood Anticline area: The Texas Co. 1 Sullivan, 1-27s-17e, dry, elev. 1,903 ft., TD 2,308 ft.

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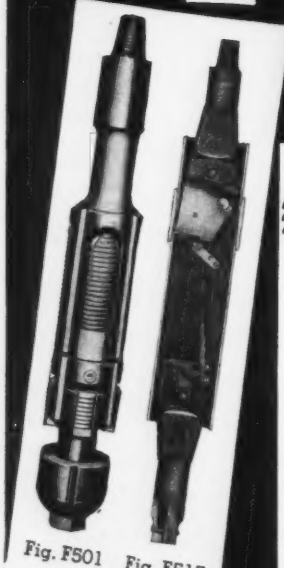

Fig. F501 Fig. F515

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EASTERN TEXAS

Rusk County Venture Tests Travis Peak

DALLAS. — Lone Star Producing Co. 1 Hall, Edwards Survey, 4 miles southeast of Kilgore in Rusk County, topped Travis Peak at 7,494 ft. and drilled soft brown sand to 7,573 ft. where it stopped for testing. With the packer set at 7,489 ft., and using 2,250 ft. of water cushion, it developed a blow of air immediately which increased during the 1 hour and 5 minutes the tool was opening. No free gas came to the surface and there was no surface pressure. However, it had a show of gas when starting to pull the tool. Recovery was the water cushion and 40 ft. of rathole mud, with no shows of oil. Bottom-hole flowing pressure was 1,100 psi. Elevation is 414 ft.

In Freestone County, Humble Oil & Refining Co. 1 McWatters, deep exploration near Donnie, was said to have recovered lost core barrel and was coring again below 16,255 ft. Unconfirmed reports said operators would set 7-in. casing on bottom, indicating considerably more drilling or the possibility of production. At last report however, the 7-in. had not been run.

I Smith County, Humble's 1 Sackett, 4 miles northwest of Bullard, swabbed gas-cut mud from perforations at 9,682-9,712 ft. Fluid level remained around 9,400 ft. from the surface. Humble 1 Kerr, Huxley field outpost in the B. P. Ayers Survey, had total depth at 6,927 ft. and was running electrical surveys. Cores at 6,912-14 ft. recovered 2 ft., being 9 in. of oolitic limestone with good gas odor, and 1 ft. 3 in. of black shale with no shows. Humble 1 Wintters remained at total depth of 9,370 ft., and was attempting to loosen stuck drill pipe. No reports were made on a core estimated at 9,352-70 ft. In Anderson County, northeast of Fosterville, Humble 1 Milner was drilling shale and lime below 8,962 ft.

Union Producing Co. 1 Travis, 6 miles northeast of Jacksonville, Cherokee County, was coring below 8,407 ft., and apparently still looking for top of the Rodessa.

In Hopkins County, Delta Drilling Co. 1 McLarry had total depth at 4,210 ft., with 5½-in. casing set 2 ft. off bottom. A drill-stem test of the sub-Clarksville sand, with packer set at 3,966 ft. to total depth 3,984 ft., recovered 960 ft. of fluid in 30 minutes. The fluid tested 180 ft. of oil, 300 ft. rathole mud, oil-cut, and 480 ft. of salt water. Bottom-hole flowing pressure was 200 psi. A test of the Coker sand, between packer at 4,152 and 4,169 ft., open 30 minutes, recovered 200 ft. of oil, 70 ft. of oil-cut mud, and no salt water. Flowing bottom-hole pressure was 325 psi.

Southwest of Birthright in Hopkins County, F. R. Jackson and W. P. Vaughn 1 Page was drilling sand at 4,910 ft. Sample top on the Georgetown lime was 4,010-20 ft., and electric log top of the Paluxy was 4,895 ft.

Arkansas Fuel Oil Co. 1 Adams, 2 miles east of Garrison, Nacagdoches County, was drilling below 7,578 ft. in sand and shale. A 20-minute drill-stem test at 7,508-19 ft. recovered 450 ft. of mud having a show of condensate.

Placid Oil Co. 1 Hill, Panola County, was drilling shale and lime below 5,012 ft.

EAST TEXAS (DISTRICTS 5 & 6) WILDCAT FAILURES

Leon County: Tex Harvey Oil Co. 1 Warren Ranch, Simon Sanchez League 8,

6 mi. SE Oakwood, dry, TD 5,755 ft., Pecan 4,005 ft., Woodbine 5,690 ft., by samples, elevation 228 ft.

Wood County: B. F. Phillips 1 Mary E. Shearer, Polly Tier Sur., 8½ mi. Winnsboro, dry, TD 6,846 ft., Nacatoch 2,022 ft., Pecan 2,877 ft., Austin 4,235 ft., Woodbine 4,670 ft., elevation 567 ft.

N. CENTRAL TEXAS

New Pool in Clay County Has Prospective Offset

WICHITA FALLS. — Clay County's new Strawn oil field northwest of Shannon had a prospective offset at Grace & Grace 2 Otis Smith, H. Tucker Survey, located 1,320 ft. west of the same company's 1 Smith. A 1-hour drill-stem test at 4,109-29 ft. recovered 70 ft. of oil-cut mud. Operators were drilling ahead to the Caddo zone at 5,040-70 ft.

Placid Oil Co. staked location for a 5,200-ft. rotary test northwest of Grace & Grace 1 Smith. It is to be the 1 R. E. Hilburn, 1,255 ft. from north and 519 ft. from east lines of the H. Tucker Survey, A-662. Bryant Edwards' deep test in the S. C. Belden Survey, southeast of Henrietta in the same county, was a failure at 6,410 ft.

South of the Acme field, S. D. Johnson 1 W. I. Holt, T. Morehead Survey, squeezed perforations at 5,778-5,814 ft. and reperforated at 5,832-46 ft. in the Ellenburger. When swabbed, it kicked off and flowed oil into tanks. No gage of the flow was reported.

In Wise County Standard-Fryer Drilling Co. 1 Morris, W. Bohn Survey, prospective 4,000-ft. southwest extension for the West Chico area, was reported to have flowed oil at the rate of 10 bbl. an hour on a drill-stem test from 5,173-81 ft., plugged back total depth from 5,247 ft. The well showed gas in 40 minutes and oil in 1 hour and 45 minutes. It was flowing oil when packer failed and another test was to be made. Previously it had made only gas from the conglomerate.

Two miles east of the town of Brideport, Wise County, Dwight M. Ross 1 G. J. Ellis, Jessee Couch Survey, reported a show of oil in Strawn sand from 3,937-50 ft. Casing was set to top of the sand and cable tools were to be moved in to drill the plug.

Fred Manning 1 Richardson, TE&L Survey, 10½ miles northeast of Throckmorton, topped the Caddo at 4,597 ft. and drilled to 4,617 ft. A 1-hour drill-stem test returned 15 ft. of mud with no shows and no pressure. It was drilling ahead below 4,620 ft. Warren Oil Corp. 1 Davis, BBB&C Survey, 8 miles southwest of Throckmorton, perforated casing at 4,734 ft. and recovered salt water with slight oil shows. Holes were squeezed and it was waiting on cement.

In northeastern Jack County, Star Oil Co. and Jack Grace 1 T. H. Cherryhomes, C. J. C. O'Conner Survey, 4 miles southeast of Cundiff, logged conglomerate showing oil from 5,309-29 ft., and was running a drill-stem test. The well is 1 mile southwest of Jack Grace 1 Jack Grace Ranch, same survey, recently completed as a small Bend conglomerate producer. It is about the same distance southwest of Hunt Oil Co. 1 Kempner, a failure at 6,713 ft. in Ellenburger dolomite.

Consolidated Oil Co. 1 Sisk Estate, Block 23, League 2, Denton County School Lands, 7 miles southwest of Wichita Falls, and a south offset to the same company's 3-A Daves, recent Caddo discovery, found the Caddo dry but had prospects of oil in the conglomerate topped at 5,328 ft. It drilled good shows of oil to 5,330 ft. After making electrical surveys, casing was set to 5,325 ft.

In Montague County, Continental Oil Co. 1-A Paul Magee, W. T. Burns Survey, 3 miles southeast of Montague, recovered 240 ft. of salt water, with no shows, on a drill-stem test of the conglomerate at 6,535-43 ft. It was drilling ahead.

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In Coleman County, Wildcats, Inc., 1 V. M. Close, H&GN Survey, 5 miles west of Coleman, reported good saturation in 27 ft. of the Ellenburger, topped at 3,743 ft. Length of drill-stem test from 3,743-78 ft. was not available, but recovery was said to be 75 ft. of heavily oil-cut drilling mud. Gas, estimated at 300,000 cu. ft. daily, came to the surface in less than 1 minute after tool was opened. Completion attempts will be made after casing is run.

NORTH CENTRAL TEXAS (DISTRICTS 9 & 7-B) SUCCESSFUL WILDCATS

Brown County: Davis, Johnson & Davis 1 Louis Garms, Sec. 23, HT&B Sur., ¼ mi. NE Bangs, 1,500,000 cu. ft. gas a day, sand 1,099-1,102 ft., TD, elevation 1,624 ft.

Davis, Johnson & Davis 1 John Stephens "A," Sec. 23, HT&B Sur., ¾ mi. N Bangs, 2,500,000 cu. ft. gas a day, sand 1,110-22 ft., TD 1,138 ft., SIP 320 psi.

Callahan County: Fresno Oil Co. 1 J. M. Morrisett, Blk. 14, T&P Sur., NW corner of county, flowed 62 bbl. 41°-gravity oil a day, open 2-in. tubing, sand 1,709-16 ft., TD.

Jones County: Richard L. Davisson, Jr., 1 Hugh Roberts, Sec. 10, Blk. 14, T&P Sur., 1½ mi. E Nugent, flowed 109 bbl. 40°-gravity oil a day, 18/64-in. choke, sand 1,662-76 ft., TD, TP 20 psi., CP 22 psi., GOR 400 cu. ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 & 7-B) WILDCAT FAILURES

Archer County: E. B. Clark, Jr., 1 J. F. O'Donoho, Sec. 8, SP Sur., 5½ mi. SW Mankins, dry, TD 3,992 ft., shot 40 qt. 4,925-41 ft.

J. W. Hawley 1 J. D. Carpenter, Blk. 4, Lot 38, Clark & Plumb Sur., 5 mi. W Windthorst, dry, TD 1,200 ft., broken sand with oil show 906-17 ft.

C. W. & Wm. L. Snoddy 1 R. J. Graham, W. B. Sweeney Sur., 2½ mi. SW Anarene, dry, TD 1,176 ft.

W. C. Young & H. S. Grace 1 A. J. Lowe, Blk. 15, Crawford Pasture Subd., 4½ mi. SE Megargel, dry, TD 1,260 ft., hard sand with oil show 1,238-40 ft.

Baylor County: Akin & Dimock 1 Farr, Sec. 228, T&NO Sur., 1 mi. NE Rendham, dry, TD 5,890 ft., Caddo 5,192 ft., no shows reported.

A. R. Dillard 1 Claud Cowan, Sec. 195, T&NO Sur., 1 mi. SW Fulda, dry, TD 2,760 ft.

G. E. Kadane & Sons 3 Quizenberry "A," Sec. 95, P. L. Leaman Sur., 2 mi. SE Rendham, dry, TD 3,160 ft.

Callahan County: W. H. Bryant 2 W. E. Milliorn, Sec. 20, BBB&C Sur., 10 mi. SW Baird, dry, TD 1,845 ft. in shale.

Comanche County: Henshaw Bros. et al 1 T. W. Pittman, Sec. 50, Blk. 2, H&TC Sur., 3 mi. SE Gorman, dry, TD 2,863 ft., Caddo 2,660 ft.

Cooke County: Hollandsworth Drlg. Co. 1 Geraldine Lewis, Melvin Langham Sur., 4 mi. S Myra, dry, TD 1,977 ft., Ellenburger 1,942 ft., elevation 972 ft.

Russell Maguire & Fleet Drilling Co. 1 J. W. Pulte, J. Shields Sur., 2½ mi. SW Myra, dry, TD 1,921 ft., top lime 1,911 ft.

Erath County: A. W. Gregg 1 R. E. House, Sargeant Sur., 5 mi. NE DeLeon, dry, TD 3,505 ft., Barnett shale 3,362 ft., Ellenburger 3,472 ft., elevation 1,430 ft.

Eastland County: A. W. Gregg et al 1 Eunice V. Krell, Sec. 66, Blk. 2, H&TC Sur., 2¾ mi. NE Gorman, dry, TD 2,053 ft.

Haskell County: Thomas B. Humphrey 2 J. M. Collins, B. Brown Sur., 10 mi. E Haskell, dry, TD 3,631 ft., Palo Pinto 3,386 ft.

Jack County: Hassie Hunt 1 Kempner, W. Burnsides Sur., 12 mi. NE Jacksboro, dry, TD 6,713 ft., conglomerate with oil show 5,344-48 ft., Ellenburger 6,650 ft.

Mills County: M. L. Happel 1 C. C. Olson, Jean Tetard Sur., 2½ mi. E Indian Creek, dry, TD 1,250 ft., brown shale 1,050 ft., Ellenburger 1,080 ft.

Palo Pinto County: Crader Oil Co. 4 E. P. Costello, McKinney & Williams Sur., 3½ mi. NW Pickwick, dry, TD 2,482 ft.

Stephens County: Nelson & Edward Morris, Ltd., 1 J. F. & Corinne Dulaney, Sec. 2,093, TE&L Sur., 6 mi. SE Breckenridge, dry, TD 3,364 ft., Caddo 3,256 ft.

Taylor County: Van Grisso Oil Co. 1 Sealy Smith, Lot 3, League 147, Grimes CSL, 4 mi. S Merkel, dry, TD 3,080 ft.

Wichita County: Burkburnett Oil Co. 1 W. C. Kemple, Blk. 242, Waggoner Colony Subd., 5 mi. N Electra, dry, TD 2,160 ft.

Young County: Reese Wingard 1 B. E. Burgess, Mose Butler Sur., 2½ mi. SE South Bend, dry, TD 540 ft.

SOUTH LOUISIANA

New Tests Have Promising Prospects

NEW ORLEANS.—Two sand sections have been tested in the second well for the North Gordon discovery area. Barnsdall Oil Co. 3 Edgewood, 13-6s-10w, Beauregard Parish, has been drilled to a total depth of 8,865 ft. A drill-stem test at 8,477-8,517 ft. recovered 9 stands of 40°-gravity oil and some gas-cut mud in 40 minutes, with bottom-hole flowing pressure being 1,200 psi. This is the same section from which the discovery well was completed. A second drill-stem test, open 40 minutes, was made from 8,810-8,865 ft. When tool was pulled recovered 72 ft. of pipe-line oil, 270 ft. of oil and gas-cut mud. Gravity of oil was 47.4°. Bottom-hole flowing pressure was from 1,000 to 1,350 psi. Shut-in pressure was 3,200 psi. Each test used 1,500 ft. of water cushion and ¼-in. and ⅛-in. chokes. The 5½-in. production string is being run and cemented on bottom at 8,865 ft.

Irwin & Hudson 1 Houssiere Latreille, a potential oil discovery in the Langley area of Jefferson Davis Parish, 6-8s-5w, approximately 4 miles west of the China field, flowed pipe-line oil for 5½ hours on drill-stem test from 8,882-8,945 ft. Salt water channeled in and tool was pulled and hole drilled ahead to present total depth of 9,523 ft. in salt water sands, in sidetracked hole. A 180-ft. cement plug was set in the bottom of the hole and a 5½-in. liner was run to the top of plug. Operators will perforate at 9,203 ft. for a squeeze job, then plug back and perforate in a higher level for the production attempt.

In the Bay St. Elaine area, Terrebonne Parish, The Texas Co. is preparing to acidize perforations in the C-1 State-Bay St. Elaine, Lease 1246, 1 mile east of Bay St. Elaine production. Total depth is 14,137 ft.

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and 7-in. casing is cemented to 12,005 ft. and liner from this point to bottom. Perforations in liner are from 13,922-970 ft. for the test.

Union Oil Co. of California 2-9 State Lease 725-LL&E Unit, a confirmation well to the Bay Junop field in Terrebonne Parish, 27-21s-14e, was drilled to a total depth of 4,593 ft. with 5½-in. production string cemented at 3,800 ft. Perforations from 3,470-3,475 ft. Operators are swabbing to complete.

The 16 new locations reported this week included 3 wildcat starts, 1 each in Jefferson, Lafourche, and Vernon parishes. Three wildcat failures were reported, one each in Acadia, Jefferson Davis, and Rapides parishes.

SOUTH LOUISIANA WILDCAT FAILURES

Acadia Parish: Nicklos-Vincent & Welch 1 Mrs. E. Perkins, 39-7s-1w, dry, TD 9,468 ft.

Jefferson Davis Parish: Falcon Seaboard Drilling Co. 1 Powell Lumber Co., in Bayou Sarpent area, 31-7s-4w, dry, TD 8,751 ft.

Rapides Parish: Kirby Pet. Co. 1 Mrs. T. G. M. DeBate, in Forest Hill area, 12-1n-2w, between Bringhurst and Forest Hill townsites, dry, TD 7,004 ft., top

CANADIAN FIELDS

New Deep Pay at North Turner Valley

CHATHAM.—Discovery of another Madison limestone block in Turner Valley below the usual porous zones is indicated in Royalite 73, LSD 9, 22-20-3w5, in the old North Turner Valley section. The well was originally completed in January 1944 as a below-average producer, drilling being discontinued around 7,300 ft. Up to June 1948 its production aggregated only 13,386 bbl. Royalite started deepening, and at 7,630 ft. topped the new lime, with first porosity at 7,734-7,830 ft. and a repeat of this horizon at 8,071-8,173 ft. The final lower zone was found at 8,343-90 ft. with black lime at 8,418 ft. The producing horizons in the original lime block have been shut off, and the new porous zones are being acidized and tested. Deepening is being undertaken in Royalite 72, LSD 15, 22-20-3w5, just northwest of Royalite 73.

Redwater.—North of Edmonton, Imperial-Redwater 1, LSD 1, 32-57-1w4, is coring below 3,156 ft. after encountering oil shown in the Devonian limestone. Reports that the well flowed 34°-gravity oil on drillstem test were not confirmed.

Lulu Island.—In the Fraser Valley of British Columbia, Royal City Oil & Gas Co. 1, on Lulu Island, encountered gas under substantial pressure around 1,853 ft. Deepening has been held up by sticky bentonite, and hole is being plugged back for a new start from 1,650 ft.

Birdsholm.—In the Birdsholm area, southern Alberta, Birdsholm-Province 65-27, LSD 11, 27-4-11w4, drilled by California Standard, has encountered a commercial gas flow in the Bow Island sand around 2,150 ft., extending the Foremost gas field by several square miles. The well is deepening below 2,290 ft. to test the Madison limestone. Location is 5 miles south of the Standard-Imperial gasser and 4 miles east of the nearest McColl Frontenac-Union Oil Co. well. Flow from the Bow Island sand was 2,800,000 cu. ft.

Hanna.—In the Hanna area, south-central Alberta, Hanna Petroleums 1, LSD 8, 5-32-15w4, encountered wet gas of undetermined distillate content in the Sunburst sand at 3,817 ft. Well is deepening in the Banff shales below 3,880 ft. and will be carried to the Devonian before making final tests. Location is 9 miles northwest of Berry Creek Petroleums 1, LSD 3, 9-31-14w4, which finished at 4,289 ft. with a similar wet gas flow from the Madison limestone.

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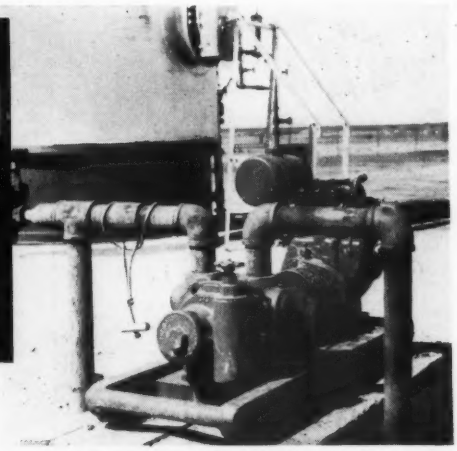

Down in Andrews County, Texas, you will find this little Model AK 4-cycle single cylinder Wisconsin Air-Cooled Engine giving an exceptionally good account of itself on an oil recycling operation.

It is reported that this unit, consisting of the AK Wisconsin Engine direct-connected to a Yale & Towne pump, pays for itself every 60 days through the oil that is saved.

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THE POSITIVE LEAK PREVENTER

Stanolind operations.—Stanolind Oil Co. is planning exploratory and development work on extensive Alberta acreage taken over from Shell Exploration of Canada. Holdings include 34,000 acres in the Jumping Pound field, where wet gas has been discovered at depth; 14,000 acres north of the Bow River; 40,000 acres between Nanton and the Watson structure and 9,000 acres, already geologized, near Hinton, some 150 miles west of Edmonton.

Leduc.—With water flooding the formation through Atlantic West Relief well, Atlantic 3, after burning wide open through 4 days, was extinguished and brought under control and is now being plugged. With the wild well under control, the Alberta Conservation Board increased allowables for other Leduc wells. For an experimental period ending September 30, D-2 wells are permitted an average of 100 bbl. with maximum of 125 bbl.; and D-3 wells an average of 150 and maximum of 175 bbl.

Central Co-Op 5, LSD 13, 25-50-26w4, is being completed as the second Leduc producer from the lower Cretaceous. After drill-stem test showed oil and gas, casing was set in the sand at 4,176 ft. Home Oil 23, LSD 7, 3-50-26w4, in the south end of the field, finished at 5,398 ft., flowed 94 bbl. an hour with gas-oil ratio of 490 cu. ft. and has been placed on restricted production. Location is ⅝ mile southeast of Imperial 9 outpost producer, and 1¼ miles northeast of Okalta-Leduc 2, the most southerly producer.

MISSISSIPPI

Routine Field Wells Mark Quiet Week

JACKSON.—Gulf Refining Co. 10 I. H. Bass, in 18-1n-16w, Baxterville field, Lamar County, has been completed for initial production of 164 bbl. of 15.2°-gravity oil flowing through a ⅜-in. choke, tubing pressure 100 psi. Total depth is 8,830 ft., with completion through 390 perforations in interval from 8,614 to 8,790 ft.

In Yellow Creek field of Wayne County, Humble Oil & Refining Co. completed B-11 G. M. & O. Land Co., 24-9n-8w, for a potential gage of 150 bbl. of 18.6° gravity pumping. Total depth is 5,081 ft., with 5½-in. casing on bottom and top of perforated interval at 5,010 ft.

Cities Service Oil Co. 5 Ayers (Roseland Plantation), 82-7n-2w, in LaGrange field, Adams County, was drilled to a total depth of 6,295 ft. and flowed 116 bbl. of oil, 41.5° gravity, through a 12/64-in. choke. Production is through perforations at 6,228-34 ft.

Three wildcat starts were reported, one each in Lincoln, Wayne and Yazoo counties. Four development locations were made, two in Yellow Creek field, Wayne County, and one each in Gwinville field, Jeff Davis County, and Heidelberg field-East, Jasper County. Two wildcat failures were reported, one each in Claiborne and Warren counties.

MISSISSIPPI WILDCAT FAILURES

Claiborne County: Placid Oil Co. 1 J. Mack Jones, 44-11n-2e, dry, TD 10,015 ft.
Warren County: The California Co. 1 Mattie H. Johnston, 15-16n-3e, dry, TD 4,876 ft.

FLORIDA

Approximately 10 miles northwest of Sunniland field in Collier County, Florida, Humble Oil & Refining Co. 1-C Gulf Coast Realty Co., 21-47s-28e, recovered 660 ft. of 20.4°-gravity oil and approximately 150 ft. of oil-cut mud with no water on a 28-hour drill-stem test through perforations at 11,918-38 ft. Additional tests are being made by operator. Should this well be completed as a commercial producer it will be the second field for the state of Florida.

FLORIDA WILDCAT FAILURE

Suwannee County: J. L. McCord 1 J. M. Starling, center NW NW 28-3s-12e, dry, TD 171 ft.

ALABAMA WILDCAT FAILURE

Geneva County: A. R. Temple 1 J. P. Faulk, 27-1n-19e, dry, TD 3,997 ft.

MICHIGAN

Two Wildcat Successes Mark Week's Activity

SAGINAW.—A Mason County wildcat oil producer and a Gratiot County wildcat gas well featured developments for the week in Michigan oil and gas fields. Of the 22 completions, 6 were oil wells, 4 were gas wells, including 3 more in Clare County. Wildcatting continued brisk but mostly without results, the completions report listing 8 wildcat dry holes along with 4 other failures in proven areas.

Superior Oil Co. reported its wildcat in Mason's Eden Township flowed 50 bbl. after acidizing on a 9-hour test. Sohio Petroleum Co. got the wildcat gas well in Gratiot's New Haven Township at 994 ft. Initial potential was reported at 5½ million cu. ft. a day.

Best of the 6 oil producers was a Carter Oil Co. completion in the Pentwater field, Oceana County, that flowed 15 bbl. per hour. Smaller wells were completed in Summit of Mason, Isabella, Allegan and Van Buren counties. Allegan County continued as the most active drilling area, 5 new locations being announced for that area. The 15 others were scattered—4 in Newaygo's Goodwell field, 3 in Van Buren County, one each in Lake, Gladwin, Crawford, St. Clair, Bay, Oceana, Ogemaw, and Shiawassee.

MICHIGAN SUCCESSFUL WILDCATS

Gratiot County, New Haven Township: Sohio Petroleum Co. 1 Williams-Gray et al, C-SW 25-10n-4w, gas well, 5,540,000 cu. ft., TD 994 ft.
Mason County, Eden Township: Superior Oil Co. 1 Bertram Sippey et al, NE SE NE 26-17n-16w, flowed 50 bbl., acidized, in first 9 hours, TD 2,359 ft. in Detroit River formation.

MICHIGAN WILDCAT FAILURES

Allegan County, Valley Township: Ohio Oil Co. 1 Hellinger, SE SE NE 21-2n-14w, dry in Traverse limestone, TD 1,378 ft.
Gladwin County, Sage Township: Michigan Oil Co. 1 Steinkraus, SE SE NE 15-19n-2w, dry in Dundee, TD 3,941 ft.
Montcalm County, Douglas Township: Leslie T. Barber 1 Lake, NW SE SW 17-11n-7w, dry in Marshall, TD 1,221 ft.
Winfield Township: William A. Comstock

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STANDCO BRAKE LINING
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HOUSTON

1 Malz, SE SW SW 30-12n-9w, dry in Dundee, TD 3,405 ft.

Muskegon County, Sullivan Township: Dale M. Leonard 1 House, SE SW NW 4-9n-15w, dry in Dundee, TD 2,340 ft.

Oceana County, Colfax Township: Superior Oil Co. 1 Ellis, SE SE NE 30-16n-15w, dry in Detroit River, TD 2,707 ft.

Van Buren County, Bloomingdale Township D. B. K. Van Raalte 1 Newcomb, SE SE SW 31-1s-14w, dry in Traverse limestone, TD 1,223 ft.

South Haven Township: Lincoln Rush and Clinton Rathburn 1 Richardson, NW NW NE 24-1s-17w, dry in Traverse limestone, TD 1,230 ft.

SOUTHWEST TEXAS

New Wilcox Discovery For Duval County

CORPUS CHRISTI. — An important new Wilcox zone discovery well in northern Duval County, 1¼ miles northeast of the Eagle Hill field, is being completed at Atlantic Refining Co. 1 Hagist, BS&F Survey 267. Drilled to a total depth of 10,081 ft., on drill-stem test, open 70 minutes, through perforations at 9,634-60 ft., using ¼-in. chokes, flowed gas and 55°-gravity condensate. Maximum working pressure was 6,000 psi. Preliminary test made through perforations at 9,950-60 ft. failed to show for production. Apparently this well is producing from the basal Wilcox, a new producing formation for this county. Only other Wilcox production in Duval County is at Magnolia's 1-A Drought, a mile northwest of the Charamousca field, and producing through perforations at 6,545-65 ft. in the upper Wilcox.

A new oil pay zone at Mercedes field, Hidalgo County, has been opened at V. E. Cook, Tr., 1 R. E. Barrow, in farm tract 2349, North Capisallo District Subd. This is a dual completion. Perforations at 7,038-53 ft. gaged 70 bbl. of oil per day through a ⅛-in. choke, with 675 psi. tubing pressure, gas-oil ratio 875. Perforations at 7,140-7,145 ft. produced gas and condensate through a 3/16-in. choke, making 645,800 cu. ft. gas per day, with 810 psi. working pressure. Total depth is 8,938 ft. with 6⅝-in. casing at 8,700 ft. These pays are in the upper Frio. Other pay zones in the field are in the Lower Frio, oil sand from 7,430-7,524 ft., and gas-condensate sands in the Vicksburg at 8,840-45 ft., and 8,880-85 ft.

A recent new oil discovery in Dimmit County, approximately 4 miles southwest of Catarina, Henderson Coquet & Algord Oil Co. 2 H. A. Dillon has been gaged at 25 bbl. of oil plus 3 to 4 bbl. of water per day on pump from open hole at 4,890-4,932 ft. in the Navarro sand. Top of sand at 4,900 ft. Total depth 5,210 ft., with plugged back depth at 4,932 ft., and 5½-in. casing set to 4,890 ft. for open-hole completion. This well is in GWT&P Survey 41, A-110, on Tract 2 of Block 11, Catarina Farms Subdivision.

Magnolia Petroleum Co. 1 Carlson Unit, wildcat test approximately 2 miles southwest of Edinburg, in Hidalgo County, has run tubing and packer for production test after perforating the casing at 10,995-11,003 ft. and 10,887-95 ft. Total depth is 11,246 ft., with 5-in. liner set to bottom, 7-in. casing is set to 10,610 ft. This well is located in Porcion 68, on Lot 7, Block 1, A. J. McCall Subdivision.

There were 26 new locations reported for Districts 1 and 4, of which 4 are wildcat starts, 1 each in Duval, Edwards, Starr and Webb counties. The 9 wildcats completed are failures, 2 in Williamson, and 1 each in Duval, Milam, Travis, Webb, Willacy, Zapata and Zavala counties.

SOUTHWEST TEXAS (DISTRICTS 1 & 4) WILDCAT FAILURES

Duval County: Bridwell Oil Co. 2 G. A. Taft, J. Poitevent Sur. 49, 3 mi. NW of Freer, dry, TD 2,812 ft.

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Milam County: Jack Amman et al A-1 Texas Power & Light Co., Jose M. Leal Gr., 10 mi. SE of Cameron, dry, TD 4,035 ft.

Travis County: Wayne Long & Mike Schigut 1 Katherine Stern, in Pedro Rodriguez Sur., 4 mi. S of Coupland, 7 mi. NE of Kimbro field, dry, TD 1,640 ft.

Webb County: Dulaney Oil Co. 6 J. G. Garcia, Block 21, Los Ojuelos Grant, dry, TD 1,872 ft.

Willacy County: Humble 4 Sauz Ranch-Tenerias, in W. H. Bowden Tr., also known as Withers Tr., in San Juan de Carricitos Grant, 10 mi. NE of Raymondville, dry, TD 8,600 ft.

Williamson County: P. J. Aylward B-1 Marjorie L. Rhoades, in W. J. Cowan Sur. 9609, 3 mi. S of Taylor, dry, TD 928 ft.

Puma O. & G. Co., Inc., 2 Rosie Simcek et al, Pedro Zarza Sur., 8 mi. SE of Granger, dry, TD 2,126 ft.

Zapata County: Daubert & Achning 1 Robert Hinnant, in Block 6, Sec. 10, H&GN Sur., 14 mi. S of Mirando City, dry, TD 1,801 ft.

Zavala County: S. H. Howell 1 T. R. Price, in B. C. Stidham Sur. 14, 6 mi. SW of Batesville, dry, TD 4,404 ft.

OKLAHOMA

Calvin Pool Gets Simpson Production

DEARDORF OIL CORP. has added a deep producing zone in Calvin pool of Hughes County. The well, 1 Joanne, SE NE NW 8-5n-10e, flowed at an estimated rate of 50 bbl. per hour with gas estimated at 3,000,000 cu. ft. from perforations at 5,584-5,610 ft. opposite pay reported as Simpson dolomite. The zone has been treated with 3,000 gal. of acid. The well also had a show in the Viola, topped at 5,503 ft. and was drilled to a total depth of 5,665 ft. in the Wilcox, topped at 5,657 ft. Other wells in Calvin pool produce from the Cromwell at about 4,400 ft.

The Lincoln County wildcat, Creekmore-Rooney Co. and Deep Rock Oil Corp. 1 Dye, SW SW SE 13-14n-5e, is showing for a Prue sand pool opener. The well was shot with 450 qt. at 3,314-99 ft. and blew for 20 minutes, making oil and gas but with some water. It has been shut in for installation of tanks and separator. Hole was drilled to 3,825 ft. in the Bartlesville and plugged back to 3,400 ft. with casing set at 3,296 ft., leaving 104 ft. of open hole. Well is located about 2¼ miles east of South Davenport field.

Ashland Oil & Refining Co. et al 1 Palmer, NE NE SW 18-11n-10e, Okfuskee County, has a good show of oil and gas in the Gilcrease. The pay was topped at 3,104 ft. and hole was carried to 3,119 ft. where a drill-stem test had gas in 4 minutes. Well is located about ½ mile east of Okemah.

Howell & Howell have staked a wildcat, 1 Cockerell, NE SE SW 5-23n-1e, Noble County, about two-thirds of the distance from the northeast end of South Ceres pool and Northeast Longview pool and on the same southwest-northeast trend that is followed by wells in South Ceres and Southwest Ceres.

OKLAHOMA SUCCESSFUL WILDCATS

Garvin County: Continental (corrected) 1 Rose-Vose, C NW NE 3-2n-3w, flowed 148 bbl. of 40°-gravity oil per day from fourth Deese sand at 8,050-8,110 ft., through ¼-in. tubing choke, TD 8,645 ft.

Hughes County: Murta 1 Ellis, SE NW SE 6-9n-11e, flowed 100 bbl. of 40.9°-gravity oil per day from Union Valley at 3,098-3,111 ft., through ½-in. tubing choke, TD 4,017 ft.

Stephens County: Samedan 1 Trotter, NW SE SE 9-1s-4w, flowed 79 bbl. of 22.8°-gravity oil per day from sands at 5,125-5,383 ft., open tubing, TD 5,425 ft.

OKLAHOMA WILDCAT FAILURES

Cotton County: C & N Drilling 1 Jones, SE SE NE 19-4s-10w, dry, TD 1,587 ft., Cache Creek sand 1,226-51 ft.

Hughes County: Burdell 1 Whiteley, SE SW NW 33-8n-9e, dry, TD 3,607 ft., Gilcrease 3,000-3,355 ft., Cromwell 3,604 ft.

Cooper 1 Talbot, SW SW SE 35-8n-10e, dry, TD 2,572 ft.

Lincoln County: Lynn 1 State, SE SW SE 16-14n-4e, dry, TD 5,083 ft., Hogshotter 2,776 ft., Checkerboard 3,125 ft., conglomerate 3,145 ft., Oswego 3,825 ft., Prue 3,868 ft., Verdigris 3,950 ft., Red Fork 4,188 ft., Mayes 4,514 ft., Woodford 4,730 ft., Hunton 4,780 ft., Sylvan 4,839 ft., Viola 4,930 ft., Wilcox 5,003 ft., second Wilcox 5,049 ft.

Murray County: Sohio 1 Arbuckle Trust, SW SE NE 7-2s-4e, dry, TD 3,750 ft., Sylvan 782 ft., Viola 1,072 ft., Bromide 1,784 ft., first Bromide sand 2,192-2,282 ft., McLish 2,282 ft., upper McLish sand 2,396-2,420 ft., basal McLish sand 2,634-2,750 ft., Joins 3,536 ft.

Noble County: Central Oil 1 Harriet, SW SW SW 7-23n-1e, dry, TD 4,570 ft., Hoover 2,120 ft., Oread 2,343 ft., Tonkawa lime 2,399 ft., middle Tonkawa lime 2,691 ft., middle Tonkawa sand 2,798 ft., lower Tonkawa sand 2,911 ft., Layton 3,149 ft., conglomerate 3,578 ft., Big lime 3,873 ft., Oswego 3,980 ft., Verdigris 4,212 ft., Skinner 4,271 ft., Red Fork 4,351 ft., Inola 4,506 ft., Mississippi lime 4,552 ft.

Abshire 1 Harper, NE NE SW 30-23n-1e, dry, TD 4,949 ft., Woodford 4,815 ft., Viola 4,836 ft., dense 4,867 ft., first Wilcox 4,901 ft., second Wilcox 4,940 ft.

Okmulgee County: Bogie 1-A Norton, NW SW NW 23-13n-11e, dry, TD 3,328 ft., Wilcox 3,325 ft.

Payne County: Summit 1 Hickman, SW SW NE 13-18n-2e, dry, TD 4,750 ft., Hogshooter 3,218 ft., Checkerboard 3,533 ft.,

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conglomerate 3,560 ft., Peru 3,820 ft., Big lime 3,851 ft., Oswego 3,934-60 ft., Prue 3,974 ft., Verdigris 4,040 ft., Skinner 4,048 ft., Red Fork 4,136 ft., Inola 4,168 ft., Bartlesville 4,190 ft., sand 4,262 ft., Mississippi lime 4,368 ft., Woodford 4,509 ft., Sylvan 4,556 ft., Viola 4,636 ft., dense 4,673 ft., dolomite 4,683 ft., Wilcox 4,697 ft., second Wilcox 4,710 ft.

Pottawatomie County: Stephens 1 Lester, NE NE SW 21-9n-3e, dry, TD 5,476 ft., Hogshooter 3,227 ft., Checkerboard 3,553 ft., Oswego 4,205 ft., Mayes 4,790 ft., Woodford 4,864 ft., Hunton 4,966 ft., Sylvan 5,130 ft., Viola 5,224 ft., first Wilcox 5,354 ft., second Wilcox 5,472 ft.

Seminole County: Sadler 1 Norvell, NE NE SE 20-8n-7e, dry, TD 3,297 ft., no tops reported.

Elson 1 Patterson, SW NE NE 35-11n-7e, dry, TD 4,418 ft., to tops reported.

KANSAS

Good Pool Opener for Stafford County

THE pool opener, Atlantic Refining Co. 1 McDonald, NE SW SW 11-21s-13w, Stafford County, has been completed for an initial production of 509 bbl. per day from the Arbuckle, topped at 3,520 ft. Total depth is 3,532 ft. The new pool, to be called East Rothgarn, is ½ mile east of Rothgarn pool but separated from it by a dry hole.

Nadel & Gussman and Peel Drilling Co. have started 1 Fischer "B," SE SE SW 25-21s-13w, Stafford County, an offset to their discovery well 1 Fischer, that swabbed 100 bbl. per hour from the Arbuckle to open Northwest Fischer pool.

Bay Petroleum Corp. and Anderson & Prichard Oil Corp. have added a new pool in McPherson County with production at 1 State Game Reserve, SE SE SW 17-18s-1w. Well topped the Mississippian at 2,834 ft. Casing was set to 2,846 ft. and the well swabbed 6 bbl. per hour for 8 hours. Total depth is 2,871 ft.

Riverview pool in Ellis County has an extension at Lindas Oil Co. 1 McNeeley, SW SW NE 30-11s-18w, where casing has been set after a recovery of 290 ft. of oil in a 20-minute drill-stem test of the Arbuckle at 3,612-20 ft. Well is located about ½ mile west of the pool.

Birmingham & Bartlett have reopened Prosper pool near the northern edge of Rice County with 1 Habiger "C," NW NE SE 6-18s-9w. Production is from the Arbuckle at 3,230-43 ft. with the well rated at 100 bbl. per day. The new well is located about ¼ mile west of the old pool.

The new-pay Arbuckle well in Westhusin pool, Rooks County, Harbar Drilling Co. and Delta Production Co. 1 Westhusin, NW NE SE 11-9s-17w, has been completed with a potential of 954 bbl. per day from pay at 3,404-14 ft. Other production in the pool is from the Lansing-Kansas City.

Gough Davis and El Dorado Refining Co. have cleaned out an abandoned well ½ mile northwest of production in Northwest Kowalsky pool in Barton County and have made a Lansing-Kansas City producer. The well, 1 Chet DeWerff, CSL SE NE 25-20s-12w, was drilled to 3,388 ft. in the Arbuckle in 1940 and abandoned without running casing. The new operators found a show of oil in the Arbuckle and then set plug at 3,250 ft. and perforated with 12 holes at 3,208-12 ft. to swab 12 bbl. of oil and 50 bbl. of water per day. They then set plug at 3,150 ft. and perforated at 3,133-36 ft. to get a fill-up of 2,000 ft. in 2 hours. The well has added importance since El Dorado and Davis gave the Northwest Kowalsky pool a maximum well extension and new pay with the completion last spring of 1 De Werff, NE SE SE 25-20s-12w, with production from the Lansing-Kansas City.

For the week, a total of 58 new locations

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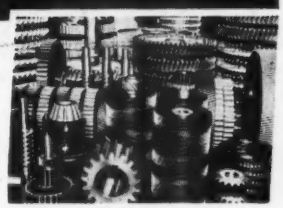

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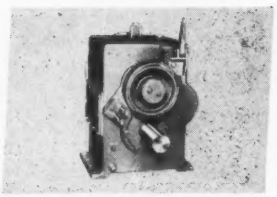

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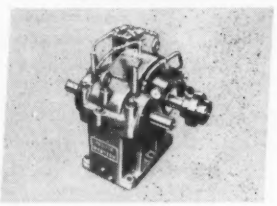

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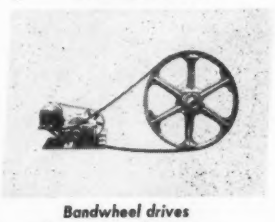

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BLACKER HAMMER

were recorded. Barton and Rice counties led with eight each, followed by Rooks with seven, Ellis with six, and Butler with five.

KANSAS SUCCESSFUL WILDCATS

Kiowa County: Rine Drilling 1 Lorimer, C SE NW 20-30s-20w, pumped 219 bbl. of 33°-gravity oil per day from Mississippian at 5,126-54 ft.; Lansing 4,430 ft., TD 5,278 ft.

Rooks County: Cities Service Oil Co. 1 Krueger, SE SE SE 35-10s-16w, pumped 905 bbl. of oil per day from Dodge and Lansing; Topeka 2,973 ft., Heebner 3,212 ft., conglomerate 3,482 ft., Arbuckle 3,649 ft., TD 3,683 ft.

KANSAS WILDCAT FAILURES

Decatur County: A. J. Stormfeldt 1 Brown, SE SW SW 21-3s-27w, dry, TD 4,075 ft., Heebner 3,522 ft., Lansing 3,544 ft., cherty conglomerate 3,972 ft., Arbuckle 4,016 ft.

Ellis County: Herndon Drilling Co. 1 Bemis, SW SW SE 29-13s-19w, dry, TD 3,932 ft., anhydrite 1,505 ft., Lansing 3,522 ft., conglomerate 3,762 ft., Arbuckle 3,872 ft.

Hamilton County: Shell Oil Co. 1 Scott, SW NE SE 28-22s-43w, dry, TD 6,043 ft., Dakota 357 ft., Morrison 655 ft., red bed 865 ft., Day Creek dolomite 895 ft., Cimarron anhydrite 1,970 ft., Topeka 3,213 ft., Lansing 3,726 ft., Patterson sand 4,586 ft., Mississippian 5,130 ft., Viola 5,732 ft., Simpson 5,897 ft., Arbuckle 5,920 ft.

Rice County: Derby & Kiowa Drilling Co. 1 Edwards, NW NW NW 4-18s-9w, dry, TD 3,255 ft., Lansing 2,888 ft., Arbuckle 3,247 ft.

Rooks County: Bridgeport Oil Co. 1 Hindman, NE NE NE 35-6s-19w, dry, TD 3,590 ft., anhydrite 1,550 ft., Lansing 3,265 ft., Arbuckle 3,538 ft., Lamotte 3,578 ft.

D. G. Hansen 1 Carlton, C S/2 SE SW 24-7s-20w, dry, TD 3,513 ft., anhydrite 1,500 ft., Topeka 2,963 ft., Heebner 3,169 ft., Lansing 3,192 ft., basal Kansas City 3,422 ft., Arbuckle 3,460 ft.

Bennett & Roberts Drilling Co. 1 Fischer, NE NE SE 4-10s-18w, dry, TD 3,790 ft., anhydrite 1,540 ft., Heebner 3,360 ft., Lansing 3,403 ft., conglomerate 3,646 ft., shaly conglomerate 3,732 ft., Arbuckle 3,760 ft.

Sedgwick County: Ausherman-Stickle et al 1 Hockett & Carter, SE SE SW 26-29s-2w, dry, TD 3,155 ft., Kansas City 2,944 ft.

ILLINOIS

Gallatin County Wildcat Makes Good Well

MATTOON.—The Gallatin County wildcat, Johnston Drilling Co. 1 G. E. Mathis, SE NE NW 17-9s-10e, is making a good McClosky well. Pipe was set and the McClosky pay was acidized at 3,047-53 and 3,058-67 ft. and the well swabbed 44 bbl. of oil per hour. Total depth is 3,092 ft. The well is about 3 miles northeast of Shawneetown, Ill., and is about 4 miles from production. Johnston has staked another location, 1 C. B. Young, SW NW NE 9-9s-10e.

The Devonian test in Clinton County, T. B. Derickson 1 Kleinstuber, NW NE NE 34-3n-1w, had gas and a show of oil with salt water after 16 holes were made at 2,845-58 ft. Casing had been set to total depth of 2,864 ft.

In Richland County, J. L. Black has set casing to test Rosiclare limestone at 1 Louis Kocher, SE NW SW 2-4n-14w, after a drill-stem test at 2,931-36 ft. had gas in 17 minutes and the recovery from the 2-hour test was 1,400 ft. of clean oil and 60 ft. of oil-cut mud. Total depth is 2,940 ft. The well is located about 1 mile northeast of Amity pool.

In Franklin County, C. H. Murdick 1 J. T. Chenault Heirs, NE SE NW 31-5s-3e, is waiting on cement on a squeeze job on the O'Hara. Operator perforated at 2,810-18 ft. and swabbed 10 bbl. per day. After acid treatment the well swabbed 4 bbl. per hour but soon made water.

In Washington County, W. C. McBride has drilled to a total depth of 3,030 ft. at 5 Herman Freeman, SE SE NW 29-3s-4w, and is preparing to plug back to the Silurian. This well is a part of the development program of the recently opened Silurian pay in the McKinley area.

M. M. Spickler has completed 1 Carl Miller, SW SE NW 6-6n-11e, an edge well in East Willow Hill pool of Jasper County. Production from the Rosiclare at 2,605-10 ft. amounted to 70 bbl. per day. Total depth is 2,610 ft.

ILLINOIS WILDCAT FAILURES

Clay County: N. C. Davies 1 Tolliver, SE SE SE 5-4n-13w, dry, TD 3,059 ft.

Lawrence County: Steve Zanetis 1 Zanetis, NE SE NE 21-3n-11w, dry, TD 1,870 ft.

Wabash County: Illinois Mid-Continent Co. 1 S. Berry, SW NW NE 30-1s-12w, dry, TD 2,510 ft.

Wayne County: Carter Oil Co. 1 L. H. Jones, SE NE SW 25-2n-9e, dry, TD 3,324 ft.

White County: Carter Oil Co. 1 Carroll, NW NW NW 19-4s-13w, dry, TD 3,042 ft.

APPALACHIAN FIELD

Westmoreland County Gets Good Gas Well

PITTSBURGH. — In Allegheny Township, Westmoreland County, Pennsylvania, Peoples Natural Gas Co. completed No. 1 Helen S. Truxall, gaging 4,000,000 cu. ft. of gas, Speechley sand 2,832-2,855 ft., gas at 2,846-2,850 ft., total depth 2,861 ft. It is located on the Freeport Quadrangle 1.55 miles

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In Amwell Township, Washington County, Robert Murray et al 1 I. W. Iams reported 1,045,000 cu. ft. gas, Big Injun sand 1,850 ft., gas at 1,858-1,868 ft., total depth 1,870 ft.

In Derry Township, Westmoreland County, Peoples Natural Gas Co. 4 Camilla Giffin, elevation 2,238 ft., topped the Onondaga at 7,215 ft. and is drilling at 7,225 ft. The Tully was logged at minus 4,199 ft., which is several hundred feet higher than in well No. 3 on the same farm.

In Georges Township, Fayette County, Orville Eberly et al 1 John Dulick, elevation was reported at 2,415 ft. and drilling at 6,814 ft.

In Wayne Township, Erie County, Pennsylvania Gas Co. 1 A. D. Peterson is drilling at 3,200 ft. in Worth Township, Mercer County, United Natural Gas Co. 1 Lowery Henderson is drilling at 545 ft.

New locations reported were three: one each in Gilpin Township, Armstrong County; Beaver Township, Jefferson County, and Bell Township, Westmoreland County.

In Pocatalico district, Putnam County, Godfrey L. Cabot, Inc., 1260 J. L. McLean Hrs. gaged 1,500,000 cu. ft. with rock pressure of 1,650 psi. in 14 hours. Oriskany sand 4,991-5,005 ft., gas 4,991-4,994 ft. Total depth 5,008 ft.

In Davis district, Tucker County, Cumberland & Allegheny Gas Co. 1-A-418 West Virginia Power & Transmission Co., elevation 3,296 ft., logged the Benson sand at 3,811-3,818 ft. and is drilling at 4,590 ft.

In Portland district, Preston County, Hope Natural Gas Co. 9208 Paul Martin, elevation 1,934 ft., topped the Onondaga chert at 5,217 ft. with gas gaging 122,000 cu. ft.

In Browns Creek district, McDowell County, Godfrey L. Cabot, Inc., 1279 Pocahontas Land Co., tested 3,540,000 cu. ft. of gas after shot in the Weir sand. Total depth 3,616 ft.

WEST VIRGINIA WILDCAT FAILURE

Calhoun County: In Sheridan district, Godfrey L. Cabot, Inc., 880 Mary V. Bunner, Corniferous lime 5,612 ft., Oriskany sand 5,798-5,867 ft., salt water 5,818-5,822 ft. and 5,860-5,865 ft. Total depth 5,863 ft.

PERMIAN BASIN

NW Upton County Test Flows From Pennsylvanian

MIDLAND.—Magnolia Petroleum Co. 1-A TXL, Ellenburger wildcat in Section 31, Block 40, T&P Survey, about ¼ mile south of the north line of Upton County, some 30 miles northwest of the Benedum field, and 10 miles east of the Crane-Upton County border, had a second oil-bearing section in the Pennsylvanian of 15-ft. thickness at 10,095-10,112 ft. Subsequent coring indicated another 5 ft. of porosity in the lime.

A drill-stem test of the section at 10,095-10,112 ft. brought gas to the top in 25 minutes, mud in 1 hour and 36 minutes, and oil in 2 hours and 36 minutes. Flowing through ⅝-in. bottom choke and 1-in. top opening, it gaged 11.53 bbl. of oil the first hour and 1.36 bbl. of oil in the next 30 minutes. There was no water and the oil tested 46.7° gravity. Gas-oil ratio was high, at around 8,650 cu. ft., with maximum volume reaching 1,783,000 cu. ft. daily. The testing tool was closed after 4½ hours and recovery in the pipe was 510 ft. of clean oil plus 480 ft. of heavily oil and gas-cut drilling mud. After the test the hole was reamed and drilled to 10,112 ft., then cored to 10,122 ft. with a diamond core bit. The top 3 ft. of the core was dense limestone, with fractures and traces of porosity which were bleeding oil. The next 2½ ft. was black shale, with no shows. The bottom 4½ ft. was limestone, having irregular porosity, and some streaks of good shows of oil and gas.

A drill-stem test higher in the Pennsylvania, from 9,321-9,345 ft. recovered 850 ft. of 40°-gravity oil, 275 ft. of oil and gas-cut mud and 180 ft. of gas-cut mud. The well has also shown promise of production in the lower Permian, thought to be the Wolfcamp. On that test, from 9,321-45 ft., open 2 hours and 5 minutes, gas came to the surface in 25 minutes, and recovery was 1,350 ft. of water blanket which was heavily cut with oil and gas, plus 860 ft. of 41°-gravity oil and 450 ft. of heavily oil and gas-cut mud. The drill pipe unloaded additional fluid while being pulled. Flowing bottom-hole pressure was 975 psi., increasing to 4,850 psi. in 15 minutes. Flowing pressures on the Pennsylvanian tests were not reported. Following the test of the Permian, packer was set at 9,295 ft. and a test run to the same total depth of 9,345 ft., with the tool open 6 hours. Recovery was 1,350 ft. of oil and 2,530 ft. of oil and gas-cut drilling mud, with the pipe again unloading some fluid when pulled. Flowing bottom-hole pressure was 1,420 psi.

Location of the well about 10 miles east of the Crane County line places it 20 miles east of the nearest oil production in the Ella Waddell pool, where production is from the San Andres around 3,400 ft. Magnolia is said to hold a block of 15,000-18,000 acres in Upton and Midland counties, which includes all the offsets except the northwest, which is held by Phillips Petroleum Co.

Fred Turner and J. M. Hewgley 1 Rosa Halff Barnett, prospective Pennsylvanian discovery in eastern Upton County, flowed 13 bbl. of oil an hour after being shut in a week. It was the first gage since filling storage.

Slick-Urschel 1 W. M. Standifer, ⅝ mile southwest of the 1 Alford, acidized the Ellenburger at 11,450-490, 11,400-430 and 11,340-370 ft. It kicked off after swabbing and flowed 2 bbl. of oil hourly, for an unreported period, showing considerable gas. There was some acid water, but no formation water. The flow was killed and preparations made to reperforate, reacidize and test.

WEST TEXAS (DISTRICTS 8 & 7-C) WILDCAT FAILURES

Gaines County: Texas Gulf Production Co. 1 Oil Development Co., Sec. 315, Blk. G, CCSD&RGNG Sur., 10 mi. NW Seminole, dry, TD 8,043 ft., Yates 3,370 ft., San Andres 4,980 ft., Glorietta 6,740 ft., elevation 3,450 ft.

Mitchell County: H. L. Hunt 1 Ellwood Estate, Sec. 31, J. P. Smith Sur., 6½ mi. NW Jameson field, dry, TD 7,454 ft., Coleman Junction 3,218 ft., sand 6,275 ft., Ellenburger 7,184 ft., elevation 2,003 ft.

Runnels County: Slick Oil Co. 1 Rhomfield, Sec. 504, W. R. Jackson Sur., 2 mi. NE Rowena, dry, TD 5,050 ft., Ellenburger 4,406 ft., elevation 1,729 ft.

Sterling County: Cole-Darden Oil Co. et al 1 R. T. Foster, Sec. 26, Blk. 13, T&P Sur., 6 mi. SW Sterling City and 1 mi. NW Anderson Prichard 1 Foster, dry, TD 5,010 ft., anhydrite 840 ft., San Andres 1,680 ft., Glorietta 2,160 ft., Clear Fork 2,350 ft., Wichita Albany 3,170 ft., elevation 2,341 ft.

Yoakum County: J. W. Murchison 1 Ellwood Fouts, Sec. 575, Blk. D, J. H. Gibson Sur., 6 mi. SW Plains, dry, TD 8,013 ft., San Andres 4,570 ft., Clear Fork 6,575 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Barnsdall Oil Co. 1-A State, wildcat test 18 miles west of Milnesand in 23-8s-32e, Chaves County, was coring ahead below 10,060 ft. It was thought to be in the basal Pennsylvanian or top of the Mississippi section. Richfield Oil Corp. 2 Comanche Unit, 24-11s-26e, continued pumping from perforations at 6,157-84 ft., gaging

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26 bbl. of fluid in 24 hours, cut 80 per cent with salt water. Plans were to reperforate in another section.

Magnolia Petroleum Co. 1 Foster Unit, 26-20s-23e, Eddy County, drilled to 2,050 ft. in limestone, prepared to run 9⅝-in. casing and will then move in cable tools to continue to 3,500 ft. Neil H. Wills 1 Wills, 8-21s-26e, set 7-in. to 1,860 ft. and was waiting on cement. It had a slight show of oil from 1,882-87 ft., total depth.

Magnolia 1 Yates-Federal, 31-9s-36e, Lea County, plugged back from 4,952 to 4,859 ft. Casing was collapsed around 1,700 ft. and operators prepared to swedge the casing. Last pumping stage was 47 bbl. of sulfur water with a rainbow show of oil.

PANHANDLE TEXAS (DISTRICT 10)
WILDCAT FAILURE

Hutchinson County: J. M. Huber 1 E. Watters, Sec. 5, Blk. M-23, TCRR Sur., 2 mi. SE Pringle, dry, TD 3,632 ft., dolomite 3,194 ft., lime 3,585-3,620 ft., no shows, elev. 3,340 ft.

ROCKY MOUNTAIN

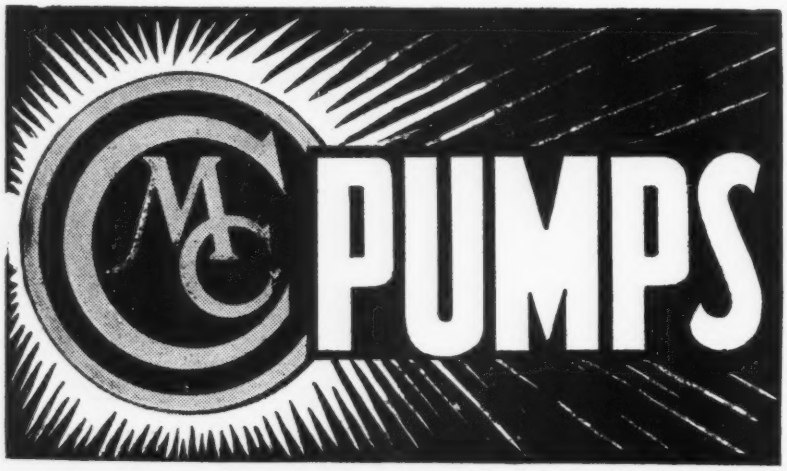
Possible Weber Production Tested in Utah Wildcat

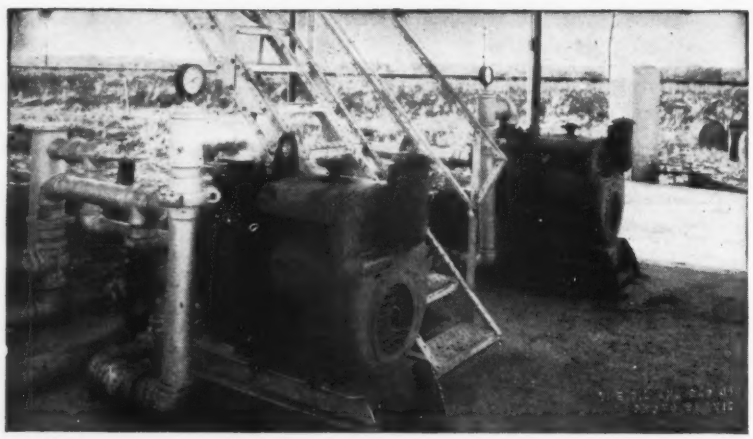
DENVER.—Possibility of an oil discovery in Utah was renewed this week with reports of saturated Weber sand in the Equity Oil Co. et al Ashley Valley wildcat, northwest of the Rangely, Colorado, field. The well is 1 Ashley Valley, C SW NW 23-5s-22e, Uintah County, and although accurate reports of the show are not available it is reported the Weber was topped at approximately 4,140 ft. A 12-ft. core in the top of the sand reportedly had good saturation and the operator is now running casing before drilling further in the sand for tests. It is also reported that the Phosphoria formation had streaked saturation in cores. The Equity Oil Co. has the majority of acreage on the Ashley Valley structure, with The California Co., Stanolind Oil & Gas Co., Rogers Lacey and others having acreage holdings in the area. This structure produced some low-volume gas for several years from wells in the Morrison formation at around 1,600 ft., but production from this formation has been depleted since 1940. Following the development of production in the Weber formation during the past few years in the Rangely field, approximately 30 miles southwest in Rio Blanco County, Colorado, there was litigation on lands at Ashley Valley, and Equity and others were recently awarded title to the lease on the lands. If the well is commercially productive this will be the first major oil discovery in the state of Utah, where there has been a great deal of geological exploration and some deep drilling in recent years. Carter Oil Co.'s Vernal Unit is west of the Ashley Valley area and Carter is now completing the fifth test on this block. Carter's wells have varied between 6,000 and 8,000 ft. in depth, and although interesting shows of oil and gas were encountered, the operator has not succeeded in finding commercial production. A number of large blocks were held throughout the Utah area of the Uintah Basin, but few of these have been drilled.

Good shows of oil were reported by Clark Drilling Co. of Billings at its 1 Wexal, NW NE SW 19-46n-64w, Fiddler Creek area, Weston County, Wyoming, and the well is reported to have made 600 ft. of oil on 30-minute drill-stem test. This is the fifth well to be drilled on this structure and previous tests have shown some saturation in the Newcastle but the sand has been hard and tight. Clark has run casing and is preparing to make tests of the well. West of the Clark well, Taylor Oil Co. prepares to test shows of oil in the Dakota after running casing. This well is 1 State, NE NE NE 26-46n-65w, and was drilled to 5,620 ft. in the Sundance and plugged back to 5,060 ft. In the Mush Creek field, several good completions have been made, including J. D. Sprecher's 3 Wakeman, NE NE SW 26-44n-63w, which made 1,900 ft. of oil on 8-minute drill-stem test. Shenton and Trigood Oil Co. 6 Wakeman, NW SW SW 26-44n-63w, is flowing 250 bbl. of oil daily after running casing on the Newcastle sand. In the Soda Buttes area, northwest of Fiddler Creek, Delta Drilling Co. and Continental Oil Co. have abandoned their 1 Nolan, SW NW NW 24-47n-66w. The well was drilled to 5,200 ft., total depth, with Morrison topped at 5,173 ft. Newcastle sand was absent and Dakota and Morrison sands were dry.

Pure Oil Co. is near abandonment on its interesting wildcat in the Gateway area at 1 Unit, NW SW SW 15-15s-104w, Mesa County, Colorado, near the Utah state line. The well is drilling below 7,875 ft., probably in granite, after drilling in granite wash from the surface. This is the first of several projected wildcats for the area on the northeast side of the Salt basin of Colorado and Utah. The well has been very costly, with more than 300 bits used in drilling the granite wash and boulders. This block lies southwest of a large fault block paralleling the Uncompaghre uplift. Pure has additional blocks southwest of the Gateway area and it is probable the company will drill additional wells in the area.

New locations.—There were 35 new locations, with 19 of the wells in Wyoming, 13 in Montana and 3 in Colorado. In Wyoming, Wilshire Oil Co. has completed a deal with Atlantic and has made location for a joint test on Atlantic's West Fourbear block, Park County. The well will be a Madison test at 1 Fourbear, C NE NE 31-48n-103w, and location is now being cleared. In the Shirley Dome area, Carbon County, Phillips and Kerr-McGee have made location for 1 Unit, NE NE SW 11-26n-81w. This well is 3 miles west of one being abandoned by Amerada Petroleum Corp. and Sohio Oil Co. which was drilled to 3,322 ft., total depth, in the granite, with no shows logged in the test. The Mush Creek-Skull Creek area of Weston County has been





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very active recently and 12 new locations were made in this area during the week. Excellent completions recently made in this stratigraphic trap area are believed responsible for the increased drilling. In Las Animas County, Colorado, Skelly has made location for a wildcat in the Tercio area at 1 Colorado Fuel & Iron, NE NE NW 29-34s-68w. The contractor will probably move in tools as soon as the company's present Baca County wildcat is completed. Other Montana, Wyoming, and Colorado new locations were for pool wells.

WYOMING SUCCESSFUL WILDCAT

Niobrara County, Bridge Creek: Pacific Western-National Associated 1 Grimes-Gov't., NW NW SE 31-39n-61w, pumped 197 bbl. per day, TD 2,595 ft., PB 2,574 ft., Greenhorn 1,575 ft., Belle Forche 1,672 ft., Newcastle 2,389 ft., Dakota 2,538 ft., 7-in. casing 2,570 ft., elev. 3,997 ft.

WYOMING WILDCAT FAILURES

Niobrara County, West Ant Hills: British-American 1 Hartung, NW NW SW 23-37n-63w, dry, TD 5,068 ft., Niobrara 3,530 ft., Greenhorn 4,232 ft., Muddy 5,023 ft., elev. 4,358 ft.

Park County, Rawhide: Wilshire Gov't., Lot 2, 16-49n-102w, dry, TD 5,553 ft., Frontier 3,625 ft., Mowry 4,165 ft., Dakota 4,990 ft., Morrison 5,148 ft., elev. 7,592 ft.

COLORADO WILDCAT FAILURE

LaPlata County, Rigid Basin: Ernst et al 1 Durango, C SE NW 8-34n-10w, dry, TD 3,779 ft., Dakota 3,468 ft., elev. 7,114 ft.

LA.-ARK.

Deep Tests Continue In Old Proven Areas

SHREVEPORT.—A number of deep operations in old areas had prospects of adding oil or gas production to those fields' known reserves. In Caddo Parish, Phillips Petroleum Co. 1 Ellerbe, 17-15n-12w, located in the old Caspina gas field, ran a 10-minute drill-stem test of the lower Glen Rose from 4,550-4,600 ft. and recovered 12 ft. of oil and gas-cut mud. The test was through ¼-in. top and bottom chokes. Maximum surface pressure was 800 psi. It drilled ahead below 5,150 ft.

In the Ruston gas field, Lincoln Parish, Crescent Drilling Co. 1 Matthews, 29-19n-2w, had no change in total depth of 9,389 ft. in the Cotton Valley. Operators swabbed down to within 125 ft. of bottom, after which the well flowed a small amount of gas. It was acidized with 1,000 gal. then tubing run on packer at 8,966 ft., but would not flow. Swabbed to 5,000 ft., it started flowing gas, distillate and salt water through ¼-in. choke. Gas was estimated at 2,000,000 cu. ft. daily. Tubing pressure was 1,600 psi., increasing to 3,200 psi. when shut in. Perforations were to be squeezed in an effort to shut off the salt water.

Northwest of the Spider gas field, DeSoto Parish, Kerr-McGee 1 Lumber, 35-12n-15w, ran a drill-stem test of Travis Peak perforations at 6,214-24 ft., after acid treatment, and made an estimated 5,000,000 to 10,000,000 cu. ft. of gas a day, through open tubing. Working pressure, with a 1-in. top opening, was 375 psi.

Union Producing Co. 1 Mansfield Hardwood Lumber Co., 4-11n-11w, DeSoto Parish, was drilling in the Travis Peak at 6,685 ft. after coring no shows at 6,350-6,525 ft. H. L. Hunt & Nebo Oil Co. 142-F Nebo, 7-13n-6w, Natchitoches Parish, was drilling anhydrous material at 6,363 ft. The California Co. 2 Breece, 30-17n-5e, Ouachita Parish, set plug at 6,260-6,330 ft., drilled out and perforated between 5,017-20 ft., but squeezed without testing. California's 2 Maxey, 32-18n-1e, drilled out to 9,380 ft., perforated at 9,298-9,314 ft., then ran a 10-

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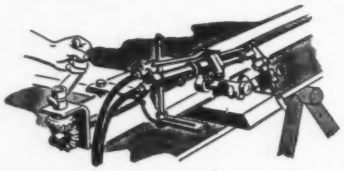

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hour drill-stem test with packer at 9,272 ft. Recovery was 11 stands of water cushion, 11 stands of mud and 76 stands of salt water. Perforations were squeezed.

Arkansas wildcats continued active but reported no important changes for the week. In Union County, 4½ miles southwest of the Hillsboro field, R. M. Crabtree 1 J. J. Bullock, 30-18s-14w, ran 4-in. liner from 2,085-2,172 ft., swabbed dry and shut in overnight. It reported 750 ft. of oil standing in the hole the next morning. Operators were waiting on standard rig for completion tests. Prospective production is from the Nacatoch sand.

Other operations included: Lee & Burnett 1-A Ollar, 27-13s-25w, Hempstead County, drilling below 5,010 ft. in unidentified formation; Stanolind 1 Bodcaw, 29-19s- 23w, Lafayette County, drilling below 9,618 ft.; Stanolind 1 Union Saw Mill, 18-19s-24w, drilling below 8,525 ft.; Jack Carnes 1 Berg, Smackover test in 27-13s-19w, Ouachita County, drilling below 3,890 ft.; Houston Oil Co. 1 Boyd, 17-13s-17w, drilling with cable tools below 3,231 ft., in chert; Carter Oil Co. 1 Ethredge, 20-19s-16w, Union County, drilling below 8,545 ft.; S. W. Richardson 1 Shell-Pratt, 36-19s-15w, drilling below 8,013 ft., with no shows.

NORTH LOUISIANA WILDCAT FAILURES

Bossier Parish: C. H. Porter 1 W. E. Atkins, 3-18n-12w, dry, TD 1,146 ft., fresh water and trace of oil in Nacatoch 1,108-13 ft.

Madison Parish: C. A. Kinard 1 Singer Mfg. Co., NW SE SE 15-15n-10e, dry, TD 5,921 ft., no tops reported.

ARKANSAS WILDCAT FAILURE

Calhoun County: Nelson Morris & Lloyd 1-C Freeman-Smith, SE NW 25-14s-15w, dry, TD 2,790 ft.

OHIO, KENTUCKY

Lorain County Gets New Gas Pool

COLUMBUS.—Another small gas pool has been opened up in Lorain County, this time along the east line of Elyria Township. The operator, Bendix-Westinghouse Automatic Air Brake Co., drilled on fee property and will use the gas in their own plants. Clinton sand came in at 2,353-62 ft. and gaged 1,240,000 cu. ft. natural.

A second gas well was completed in the northeast part of Montgomery Township, Ashland County, by Denbow et al on the Emma Plank tract in Section 12. Clinton sand at 2,662-68 ft. gaged 400,000 cu. ft. natural and 1,210,000 cu. ft. when shut in after shot.

The Four Way O. and G. 1 H. H. Cochran, Section 22, Hopewell Township, Perry County, found 421,000 cu. ft. gas in the Berea at 814 ft. The well was intended for the Clinton to offset the 1 Murray Coble.

Clay Hicks et al 3 L. G. Simms, Section 23, Bearfield Township, Perry County, a sub-Trenton test, drilled into the St. Peter sand from 6,058-90 ft. with water at 6,090 ft. The operator is undecided about further drilling.

The first of the three wildcat tests in Washington Township, Stark County, Park O. & G. 1 Leslie Weaver, Section 22, has been drilled through the Clinton with only a small showing of gas. Sand was logged at 5,258-5,343 ft.

Locations were up to 28, from 16 counties for the week. Perry continues to lead, having 5, and was followed by Washington With 4. Mt. Vernon field led in completions with 7 out of a total of 27.

EASTERN KENTUCKY

ASHLAND.—Drilling is still progressing, though slowly, at Dyer, Patterson & Roeder 1 N. V. Bond, 25-L-66, Jackson County. At 4,245 ft., operators were some 1,300 ft. in the Knox dolomite with no commercial shows encountered to that depth.

An apparent wildcat failure seems to be in prospect at Sam Allen et al 1 Harvey Bush, 4-R-65, 1½ miles southeast of Winchester, the county seat of Clark County. Topping the Knox dolomite at 860 ft., operators have been plagued with water to present depth of 1,689 ft. However, the hole may be carried on to greater depths before abandoning.

The showing of oil reported several weeks ago in Arch Carpenter's 1 Wasson, 20-P-68, Powell County, in the Furnace gas field proved to be a dud. Evidently a pocket of oil was struck at 2,520 ft. in the Stones River-Black River series overlying the gas-producing St. Peter horizon. However, the oil soon blew out. Operators then carried the well on down to the St. Peter sand for completion as a gas producer.

WESTERN KENTUCKY

OWENSBORO.—Sohio Petroleum Co. has completed 2 Mauzy-Wilhite, 18-P-26, at the north end of Hebbardsville pool in Henderson County. Initial production was 60 bbl. per day on pump from the Tar Springs at 1,503-07 ft.

Webster County's deep test, Pure Oil Co., Ashland Oil & Refining Co. and I. B. Browning 1 M. L. Walker, 22-N-24, is drilling at 2,920 ft. in black shale in the top of the Devonian.

Miller & Shiarella and Ashland Oil & Refining Co. have completed 1 L. G. Leachman Heirs, 18-N-28, at the east end of Guffie pool in McLean County. Well was completed with an initial production of 25 bbl. per day from the Cypress at 1,915-31 ft. with casing set to 1,951 ft. Total depth is 1,997 ft.

WESTERN KENTUCKY WILDCAT FAILURE

Henderson County: Aurora Gasoline Co., F. J. Fleming, and A. K. Swann 1 W. H. Watson Comm., SE SE NW 17-O-22, dry, TD 2,753 ft.

INDIANA

EVANSVILLE.—Posey County has another good well opening an area about 6 miles northwest of Evansville and west of Vienna pool. The well, A. J. Slagter 1 C. Harrenbruck, SW NE SW 2-6s-12w, had gas in 14 minutes and flowed clean oil in 52 minutes in a drill-stem test of the Rosiclare at 2,630-44 ft. The well also had a show in the McClosky where the recovery from a 1-hour drill-stem test at 2,648-71 ft. was 60 ft. of oil-cut mud, 60 ft. of mud slightly cut with oil, and another 30 ft. of salty mud slightly cut with oil but no water. Casing has been set to 2,654 ft. for further test of the Rosiclare. Total depth is 2,671 ft.

In the southern part of Vanderburgh County, S. D. Jarvis has set casing for a test of the McClosky at 1 Donald Kolb, SE SW NW 22-7s-11w. A 2-hour drill-stem test at 2,392-2,417 ft. recovered 300 ft. of oil, 250 ft. of mud-cut oil, and 350 ft. of salty oil-cut mud. Total depth is 2,505 ft.

F. B. Cline has started another well in the recently opened Devonian pool, Wilfred, in Sullivan County. The well, 2 M. Pittman, NE SW SE 30-9n-8w, is a northeast diagonal offset to the big well which has been completed with an initial production of 530 bbl. per day through 1/32-in. choke. Cline has run casing at 2 Harry Seipman, NW NW SE of the same section, and is running casing at 1 K. Drake, NE NW NW 30-9n-8w. No drill-stem tests were reported for these wells but they are cased for tests of the Devonian. Operator may try a squeeze job at 1 Leon Wallace, SW NW NE of the same section. Perforations were made at 2,021-25 ft. and the well flowed 250 bbl. of oil and 200 bbl. of water through 1-in. choke in 24 hours. In the first 36 hours, the well had flowed by heads to make 500 bbl. of oil and 500 bbl. of water.

INDIANA WILDCAT FAILURE

Vanderburgh County: Joe Linzy 1 Fred Hople, SW NE SE 16-6s-11w, dry, TD 2,526 ft.

Eight Months' Completions Gain 17 Per Cent Over Last Year

by Polly De Armond

PRELIMINARY cumulative figures for the first 8 months of the current year reflect gains in both number of wells completed and in total depth drilled as against those for the same time last year. Completions totaled 25,090, an increase of 3,700 wells, or 17.3 per cent, and of this number of wells 64 per cent were oil or gas producers—about the same ratio of successful completions for the 1947 period. Footage reached 86,418,663 ft., an increase of 12,010,659 ft., or 16.1 per cent.

South and West Areas

Percentagewise, the greatest increase for the period of January 1 to September 1 was recorded in the Rocky Mountain region which was up 46.6 per cent in finished wells and 60 per cent in footage. The Pacific Coast was second highest in percentage gains for completions, up 45.1 per cent, but reflected several "grass roots" drilling operations this year with only a 19.9 per cent gain in footage.

Louisiana, Arkansas, Mississippi, Tennessee, Alabama, Georgia, and Florida had an aggregate of 1,970 completions, an increase of 406 wells, or 25.9 per cent. Footage for this area totaled 10,093,270 ft., a gain of 627,809 ft., or 6.6 per cent over last year.

Central Sections

The north central states of Ohio, Indiana, Illinois, Kentucky and Michigan reported 4,178 completions against 3,516, an 18.8 per cent increase, with a total depth of 9,598,132 ft. drilled so far this year compared with 8,441,100 ft. for the corresponding months in 1947, a 13.7 per cent gain.

The Mid-Continent division, including Oklahoma, Kansas, Nebraska, Missouri and Iowa, had 4,806 completions for the 8 months, which was a 13.4 per cent gain over last year. Footage for these states reached 16,231,160 ft., which was almost 3,000,000 more feet than were drilled in 1947, representing a 21.3 increase.

Texas and New Mexico noted a 22.4 per cent gain in completions which totaled 4,806 against 4,238, and a 19.2 per cent increase in footage which reached 34,685,244 ft., compared with 29,102,019 ft. for January through August last year.

East Coast

The eastern district, comprised of New York, Pennsylvania, West Virginia, Virginia and Maryland, showed the only decreases for the period. There were 3,469 completions, a loss of 226 wells, or 6.1 per cent, and 5,892,810 ft. drilled, a decrease of 458,421 ft., or 7.2 per cent.

Rigs and Drilling Record

With 4,801 active rigs reported at the end of August (a new record), it would seem that operators still hope to accomplish their scheduled all-time high in completions for this year. Although the number of finished wells dropped 281 from the July record of 3,767, the 3,486 wells completed during August displaced June for the second highest number of monthly completions for 1948 by 205 wells.

SUMMARY OF COMPLETIONS, AUGUST 1948

	Total comp.	Oil	Initial prod.	Gas	Dry	Under 2,500 ft.	2,500-5,000 ft.	5,000-7,500 ft.	7,500-10,000 ft.	Over 10,000 ft.	Total footage	Rigs and drilling
New York	120	60	127	0	60	120	0	0	0	0	173,712	152
Pennsylvania	299	156	342	19	124	272	27	0	0	0	471,839	273
West Virginia	68	14	304	42	12	36	30	2	0	0	178,308	221
Ohio	144	46	1,030	43	55	73	71	0	0	0	345,990	198
Indiana	111	61	7,543	0	50	91	20	0	0	0	209,622	112
Kentucky	72	31	1,790	8	33	62	10	0	0	0	120,330	57
Illinois	217	102	11,218	2	113	68	149	0	0	0	563,332	257
Michigan	104	40	20,949	0	64	63	41	0	0	0	238,445	144
Kansas	290	144	68,783	31	115	32	254	4	0	0	940,834	391
Neb., Mo., Iowa	3	0	0	0	3	2	1	0	0	0	9,219	12
Oklahoma	394	206	18,292	42	146	140	172	69	5	8	1,393,953	603
Texas	981	625	110,521	39	317	249	431	197	82	22	4,218,772	1,115
North	215	116	13,902	1	98	111	76	27	1	0	633,344	141
West Central	107	54	14,564	4	49	37	68	2	0	0	309,586	89
West	251	213	56,859	2	36	42	132	40	25	12	1,226,785	212
Panhandle	55	44	3,295	9	2	1	52	2	0	0	177,860	169
Eastern	47	28	4,755	5	14	3	23	14	7	0	246,998	74
Gulf Coast	154	90	9,174	12	52	15	45	57	28	9	904,331	252
Southwest	152	80	7,972	6	66	40	35	55	21	1	719,868	178
Louisiana	194	128	11,295	9	57	97	20	20	22	35	936,157	260
Northern	125	89	5,866	9	27	95	10	13	6	1	325,048	80
Southern	69	39	6,229	0	30	2	10	7	16	34	611,109	180
Arkansas	27	10	1,236	0	17	4	14	7	2	0	123,486	34
Mississippi	39	21	3,893	2	16	0	2	18	10	9	293,641	47
Ala., Ga., Fla.	7	0	0	0	7	1	4	1	1	0	31,315	17
Montana	31	17	701	1	13	24	6	0	1	0	77,129	51
Wyoming	§71	46	9,031	1	§24	9	§42	17	2	1	309,344	214
Colorado-Utah	13	12	1,940	1	0	0	1	12	0	0	81,695	97
New Mexico	41	30	4,053	2	9	10	18	9	3	1	172,257	146
California	260	210	36,933	2	48	8	92	80	71	9	1,013,573	400
Total August 1948	3,486	†1,959	309,981	244	*1,283	1,361	1,405	436	199	85	11,902,953	‡4,801
Total July 1948	3,767	2,105	302,743	289	1,373	1,379	1,587	471	243	87	13,106,512	4,720
Total August 1947	3,302	1,772	303,012	304	1,226	1,428	1,277	517		80	11,332,441	4,447

*Incl. 213 service wells: N. Y. 60, Pa. 120, Ohio 8, Ky. 1, Mich. 17, Kans. 5, Okla. 2. †Incl. 25 distillate wells: E. Tex. 1, Tex. Gulf 8, S.W. Tex. 2, No. La. 1, So. La. 12, N. Mex. 1. ‡Incl. all wells rigged up and/or drilling at end of month. §Incl. S. Dak. 1.

STATISTICS and T

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 18, 1948

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1948				
	Comp.	Oil	Gas	Dry	Footage	1948	1947	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	27	14	0	*13	30,806	1,101	1,178	0	0	0	0	0	0	0	0	0	0
Pennsylvania	45	20	4	†21	70,397	1,872	2,124	0	0	0	0	0	0	0	9	13	22
West Virginia	18	4	9	5	37,565	581	605	0	0	0	1	1	3	0	34	37	74
Ohio	27	7	4	‡16	62,398	976	942	0	0	0	0	0	2	0	9	23	34
Indiana	31	18	0	13	58,472	756	457	0	0	0	1	1	20	0	1	39	60
Kentucky	19	4	6	9	40,757	514	486	0	0	0	1	1	7	0	0	21	28
Illinois	50	21	0	29	137,659	1,702	1,473	0	0	0	5	5	34	0	1	266	301
Michigan	22	6	4	12	42,339	595	623	1	0	1	8	10	14	0	9	185	208
Kansas	79	43	8	‡28	262,789	2,202	1,857	2	0	0	8	10	43	0	5	302	350
Neb., Mo., Iowa	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	4	4
Oklahoma	96	58	6	32	413,314	2,937	2,985	3	0	0	12	15	94	7	22	458	581
Texas	249	141	15	93	1,067,416	8,392	6,535	4	0	4	51	59	245	23	76	1,469	1,813
North Central (Dist. 7-B & 9)	72	31	3	38	217,649	2,625	2,112	2	0	2	21	25	89	0	12	530	631
West (Dist. 7-C & 8)	59	48	1	10	276,608	2,277	1,575	0	0	0	5	5	53	0	3	165	221
Panhandle (Dist. 10)	13	10	2	1	40,141	447	317	0	0	0	1	1	0	0	3	8	11
Eastern (Dist. 5 & 6)	14	8	2	4	68,123	396	373	0	0	0	1	1	9	2	0	82	93
Gulf Coast (Dist. 2 & 3)	50	22	6	22	319,436	1,335	1,142	2	0	2	14	18	58	18	23	320	419
Southwest (Dist. 1 & 4)	41	22	1	‡18	145,459	1,312	1,016	0	0	0	9	9	36	3	35	364	438
Louisiana	46	32	1	13	180,619	1,635	1,052	0	0	0	5	5	37	20	4	153	214
Northern	35	27	1	7	85,821	1,094	599	0	0	0	2	2	3	2	0	76	81
Southern	11	5	0	6	94,798	541	453	0	0	0	3	3	34	18	4	77	133
Arkansas	6	5	0	1	21,752	211	207	0	0	0	1	1	5	0	0	64	69
Mississippi	7	5	0	2	45,457	294	346	0	0	0	2	2	3	1	3	69	76
Southeastern States	2	0	0	2	4,168	40	44	0	0	0	2	2	0	0	0	37	37
Montana	6	4	0	2	14,435	200	200	0	0	0	0	0	3	0	0	15	18
Wyoming	8	5	0	3	35,194	377	169	1	0	0	2	3	20	0	1	43	64
Colorado-Utah	3	1	1	1	15,585	166	146	0	0	0	1	1	0	0	5	32	37
New Mexico	6	6	0	0	29,476	434	381	0	0	0	0	0	4	1	1	37	43
California	55	39	2	14	191,502	2,077	1,398	1	0	0	11	12	93	1	5	222	321
Total United States	802	433	60	309	2,762,100	27,067	23,212	12	0	5	111	128	627	53	185	3,489	4,354
Total previous week	766	451	50	265	2,659,576	26,265	22,479*	20	0	3	98	121	615	53	180	3,378	4,226
Total September 20, 1947	733	403	81	249	2,467,329			21	0	7	79	107	507	67	152	2,855	3,578

Service wells included: *13, †19, ‡1.

CRUDE PRICES AND REFINERY ACTIVITY

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Okla-homa, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$2.17	....	....	....
19-19.9	2.19	....	....	....
20-20.9	2.21	$2.25	....	$2.12
21-21.9	2.23	2.27	....	2.14
22-22.9	2.27	2.29	....	2.16
23-23.9	2.30	2.31	....	2.18
24-24.9	2.34	2.33	$2.56	2.20
25-25.9	2.38	2.35	2.58	2.22
26-26.9	2.41	2.37	2.60	2.24
27-27.9	2.45	2.39	2.62	2.26
28-28.9	2.49	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.56	2.45	2.68	2.32
31-31.9	2.59	2.47	2.70	2.34
32-32.9	2.62	2.49	2.72	2.36
33-33.9	....	2.51	2.74	2.38
34-34.9	....	2.53	2.76	2.40
35-35.9	....	2.55	2.78	2.42
36-36.9	....	2.57	2.80	2.44
37-37.9	....	2.59	2.82	2.46
38-38.9	....	2.61	2.84	2.48
39-39.9	....	2.63	2.86	2.50
40 and above	....	2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point. †Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947. (For detailed price changes in all fields see The Oil and Gas Journal, January 1, 1948, page 107.)

A.P.I. REFINERY REPORT, WEEK ENDED SEPTEMBER 11

District—	Crude runs, daily avg.	Production (Thousands of barrels) Gasoline†	Kerosine	Gas & dist. oil	Residual	Stocks at refineries, bulk terminals, in transit and in pipe lines Gasoline*	Kerosine	Gas & dist. oil	Residual
East Coast	863	2,286	247	1,222	1,597	22,478	10,914	22,021	12,794
Appalachian:									
District 1	103	316	39	89	86	2,205	461	811	406
District 2	26	97	5	37	68	979	99	264	181
Ind., Ill., Ky.	923	3,372	338	916	1,046	18,891	4,610	11,231	6,196
Okla., Kans., Mo.	449	1,596	143	601	521	8,243	1,429	5,964	2,366
Inland Texas	255	1,126	86	207	427	3,356	740	1,100	1,099
Texas Gulf Coast	1,512	4,414	754	2,452	2,154	14,091	2,902	9,898	8,874
La. Gulf Coast	436	1,386	323	657	545	5,541	1,609	4,119	2,785
N. La. and Ark.	87	241	59	89	134	2,309	475	515	303
Rocky Mountain:									
New Mexico	12	45	7	12	28	78	25	51	31
Other Rocky Mtn.	159	494	37	200	221	1,903	289	1,381	1,031
California	(California figures not available because of refinery strike)								
Sept. 11, 1948‡	4,825	15,373	2,038	6,482	6,828	80,074	23,553	57,355	36,066
Sept. 4, 1948‡	4,644	14,903	1,865	6,302	6,442	80,574	22,903	55,019	34,288

*Finished and unfinished. †At refineries including natural blended. ‡Excluding California.

Bureau of Mines crude-oil stocks 221,507,000 bbl. as of September 11 —down 1,202,000 bbl. One year ago 226,509,000 bbl.

FLAT CRUDE PRICES

Representative posted schedules per bbl.

East Texas	$2.65	Pecos County, Texas (Yates)	2.35
Kettleman Hills, California*	2.14	Bradford, Pennsylvania	5.00
Beauregard Parish	2.60	Eastern Ill. and Western Ind.†	2.77
Illinois Basin	2.77	Tomball, Texas Gulf Coast	2.83

*37°-37.9°. †35° and above.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

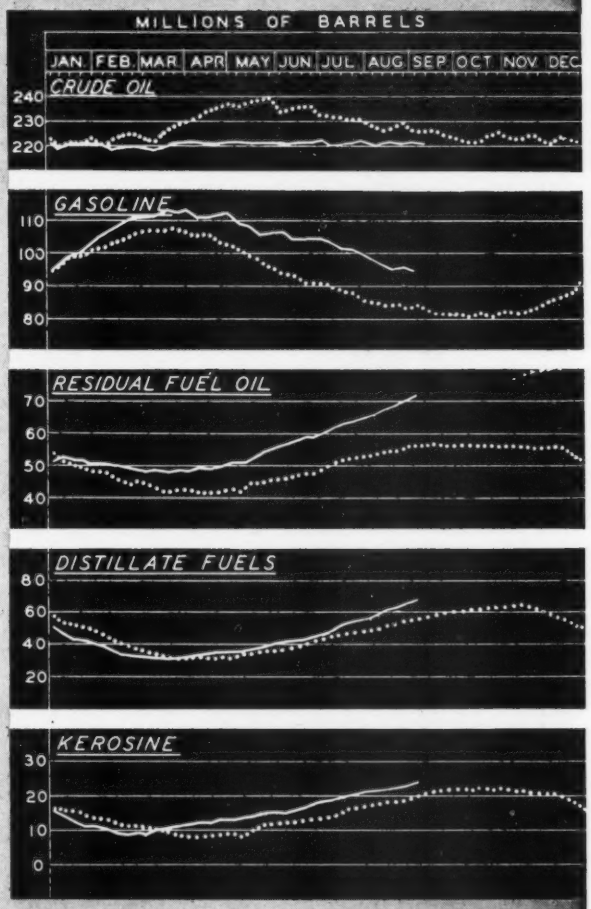
	Sept. 18 crude oil	B. of M. Sept. demand	Sept. 11 crude oil
Alabama	1,300	1,200	1,400
Arkansas	83,200	90,000	82,450
California	766,600	955,000	953,000
Colorado	48,760	50,000	48,110
Eastern	62,800	66,300	64,750
Florida	800	800	800
Illinois	179,800	170,000	176,000
Indiana	22,500	17,000	25,100
Kansas	303,550	307,000	296,900
Kentucky	24,500	24,000	25,600
Louisiana	485,350	500,000	484,750
North Louisiana	114,250	.....	113,650
South Louisiana	371,100	.....	371,100
Michigan	46,400	46,000	49,600
Mississippi	125,800	131,000	126,900
Montana	22,830	27,000	25,710
Nebraska	350	700	400
New Mexico	131,535	138,000	131,535
Oklahoma	429,500	438,000	429,000
Texas	2,470,900	2,520,000	2,470,900
Dist. 1 (Southwest)	28,660	.....	28,660
Dist. 2 (Southwest)	179,950	.....	179,950
Dist. 4 (Southwest)	250,425	.....	250,425
Dist. 3 (Gulf Coast)	494,515	.....	494,515
Dist. 5 (Eastern)	49,150	.....	49,150
Dist. 6 (Eastern)	119,725	.....	119,725
East Texas Field	312,800	.....	312,800
Dist. 7-C (West)	45,300	.....	45,300
Dist. 8 (West)	708,950	.....	708,950
Dist. 7-B (W. Central)	53,275	.....	53,275
Dist. 9 (N. Central)	141,150	.....	141,150
Dist. 10 (Panhandle)	87,000	.....	87,000
Wyoming	153,850	158,000	149,280
Total United States	*5,360,325	5,640,000	5,542,185
Change from prev. wk., dn.	181,860		

Total production January 1-September 18 †1,437,245,435 bbl.
Same period last year (crude plus cond.) 1,303,770,225 bbl.

*Not incl. 74,640 bbl. condensate. †Incl. 19,440,345 bbl. condensate.

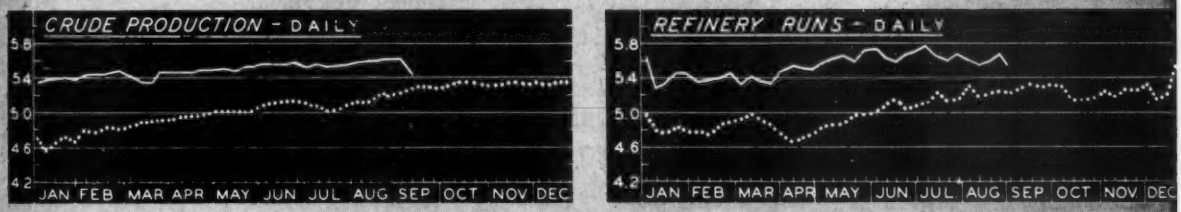
STOCKS IN UNITED STATES

---- 1947 ——— 1948



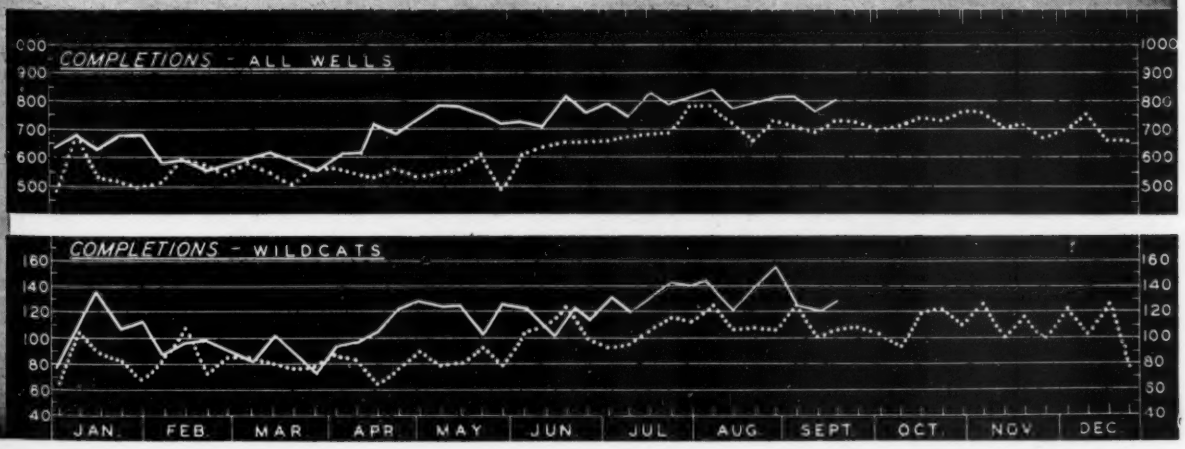
DAILY OPERATIONS

---- 1947 ——— 1948

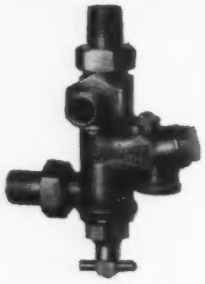


WEEKLY COMPLETIONS

---- 1947 ——— 1948



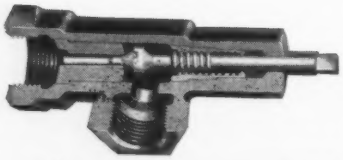
PENBERTHY
AUTOMATIC
INJECTORS



The accepted method for assuring an uninterrupted supply of feed water to oil field boilers. Penberthy Automatic Injectors will supply feed water to boilers at minimum cost, are quickly and easily installed, reliable under most severe operating conditions, require little attention and no careful handling. Highest quality design and rugged construction.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

IT'S
TAMPER-PROOF



WELSBACH
HIGH PRESSURE
SERVICE GAS
VALVE

Component parts cannot be disturbed without removal of complete valve from line.

This WELSBACH Valve also provides metal to metal seating in both open and shut positions . . . eliminates service line pressure from operating parts when in full open position . . . is designed for use in medium and high pressure lines just ahead of gas regulator. Other advantages include: Easy to align with service and regulator lines; Easy to turn on and off; Factory tested at 150 p.s.i. gas working pressure; Low in maintenance and installation costs. Write for descriptive literature.

THE WELSBACH CORPORATION
KITSON DIVISION
1500 Walnut Street, Philadelphia 2

MARKETS

THE term "sloppy" was used sparingly, but it was used, by Mid-Continent suppliers last week in describing the current market for petroleum products.

Both gasoline and No. 2 fuel oil were easily obtainable, with gasoline moving at new lows for the season. Scattered movements of regular gasoline were reported shipped at a figure as low as ¼ cent "below the low of published prices."

A great deal of slack existed in the heavy fuel oil market, as refiners reported their No. 6 storage facilities "full to overflowing." Cutbacks in the delivery of natural gas to industrial firms in the East, expected with the advent of late autumn and a consequent increase in home-heating demand, would have a price-lifting effect on the product, but suppliers agreed the long-term price outlook for the product was "poor."

Slack Along Gulf

Mid-Continent suppliers felt that a tightening on the Gulf Coast could have a marked effect on the Mid-Continent market, but there, also, there was a noticeable weakness in all products.

Motor fuel on the open spot market was reported moving at below-publication prices in the Texas Gulf Coast area. The situation reflected the continuing improvement in products supply. Some premium-grade motor fuel was being shipped at prices ranging around 11 cents, and regular was being traded, according to reports, at 10¼ cents.

Burning oils also were weak on the spot market. Storage was reported generally filled on the East and Gulf Coasts with the heavy winter demand not yet commenced. One official said he knew of no tank-car shipments as yet to the strike-bound West Coast but added he expected such a development if the strike is prolonged.

Lubricating oils over the nation also exhibited a certain weakness. South Texas lubricating oils were reported "readily available" and moving within published price ranges. In New York, several refiners dropped as much as 2 cents a gallon from their posted prices in order, they said, to "meet competition." One refiner indicated he soon would drop his Penn Grade quotations, while others said they would maintain postings on these products as long as possible.

East Coast Market Quiet

Kerosine and No. 2 prices in New York Harbor remained practically unchanged and were described as not difficult to obtain at only slightly above posted prices.

A majority of suppliers in New York reported their stocks of heating oils well above those of last year. Storage was generally filled, and some suppliers were selling products to other than regular customers. In these cases, they said, there was an understanding that no guarantee of later supplies was involved.

The market for No. 6 fuel oil remained sloppy on the East Coast, and offerings were in evidence below harbor postings of $3.

Movement of No. 6 from the Gulf was slow, and several cargoes of the product priced at $2.46 were reported still unsold.

One independent New York supplier last week raised his kerosine barge price .2 cent to 10.5 and his No. 2 price to 9.5 for shipment to the New York side of the harbor.

Representative Quotations

Representative spot-market quotations of leading suppliers as of September 20, 1948. Figures are f.o.b. plant for tank-car shipment in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor	Texas Gulf Coast
Regular gasoline, 73-75 octane	10¼-10½	11.6-12* 10.5-11.9†	10¼-11
Premium gasoline, 78-80 octane	11-11¼	10.6-13.4	11-11¾
42-44 w.w. kerosine	9½-9¾	10.3-11.7	9½-10¼
No. 2 straw fuel oil	9-9¼	9.4-10.1	9-9½
No. 6 residual	$2.00-2.20	$3.03-3.37	$2.10-2.65

*Branded (74-76 octane); †Unbranded (74-76 octane).

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	8½	8	8¼
Grade 18-55	10.2	9.6	9.9

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	12-14.5
750 vis., No. 3-4 neutral	15-17.25
2,000 No. 5-6 neutral	17-21

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	33
200 vis. No. 3 neutral, 0-10 pp.	19

Western Pennsylvania

145-155 vis. 10 p.t. bright stock	47
180 vis. p.t. neutral	48

CRUDE-SCALE WAX

Mid-Continent

132-134 A.S.T.M. melting point	6

Holman Warns N. P. A. Against Price Dislocations

(Continued from page 148)

getting into a series of spurts and collapses. This would bring about serious dislocations in the industry, together with public criticism, loss of confidence, and regulation of one sort or another."

Other aspects of the "new look" in oil seen by Holman are the challenge to keep increasing the quality of products and efficiency in their use, and particularly to compete in developing better technological processes and equipment. "Here, perhaps," he said, "will be involved the greatest test we operators have ever faced. Our individual abilities to hold our competitive positions, and the nation's ability as a whole to produce and use oil products ever more efficiently, will be dependent upon the degree of technical skill which can be achieved in the design, installation, and operation of new equipment."

N. A. C. E. Reports on Corrosion Prevention

(Continued from page 152)

that of static and cyclic. He also said proper placing of tube baffles would show reduction in cyclic stress-corrosion failures in tubes and that careful design of tube bundles would result in less failures from static type of stress-corrosion.

In his paper, "Steam Reboiler Corrosion," W. S. Janssen, Pan American Refining Corp., related some of the experiences obtained in combating corrosion in equipment operating in alkylation service at Texas City, Tex. First corrosion attack in the particular reboiler installation, a sulfuric acid alkylation unit, was found at the floating tube sheet end. Appearance of the tube sheet and cover of the reboiler was that of sand blast. The second type was in the form of longitudinal grooving throughout the length of the first pass tubes and irregular corrosion of the inner surfaces of the outlet tubes. Rate of attack was found to be very erratic and during one period (1,000-2,000 hours) the rate was found to exceed 0.04-in. per year.

Investigation of equipment design disclosed turbulent flow at the tube ends because of close clearance between cover and tube ends. By correcting this condition and removing noncondensable gas on the steam side difficulties with the installation seem to have been eliminated.

Corrosion problems encountered in the manufacture of sulfuric acid were discussed in the paper presented by T. L. Hart, National Zinc Co., Bartlesville. Lead is the principal material employed to combat corrosion in certain areas in this manufacturing process.

A paper describing the use of the microscope in corrosion problems was presented by H. M. Wilten, The Texas Co., Port Arthur. Wilton illustrated the importance of the microscope in studying corrosion with a large group of slides. This paper carried the title "The Microscope as an Aid in Solving Corrosion Problems."

Magnesium Anodes Discussed

Economic advantages of rectifier bed and sacrificial anode installations were compared by E. P. Doremus, Cathodic Protection Service. Cost of current produced from magnesium anodes approaches the cost of current for rectifier ground beds. But when actual current requirements are taken into consideration, the cost of the distributed magnesium anode installations are almost invariably less. Current requirements for distributed small-drain-point-magnesium anode installations may be 10 to 20 per cent of those for adequate protection with rectifier ground bed installations. Maintenance cost of sacrificial anodes is less. Furthermore, it is reported that installation of magnesium anodes costs 75 per cent of what it costs for rectifier installations.

R. L. Featherly, Dow Chemical Co., read a paper prepared by H. A. Robinson, Jr., of the same company, on the installation and performance of magnesium ribbon anodes. Galvanic anodes are definitely limited to applications in high resistivity soil. Very small anodes would solve the problem if installation costs were not prohibitive. The extruded magnesium ribbon, ⅜ by ¾-in. with continuous 13-gage steel wire core is better than small anodes. Such a ribbon is not suited to low resistance soils. The ribbon is plowed in by telephone plow, 2 to 10 ft. from the pipe line at depths of 16 to 22-in. At 500 to 1,000-ft. intervals, connections are made by No. 8 wire leading from the 13-gage steel core of the ribbon to the pipe line.

High-resistance soils—5,000 to 25,000 ohms per cu. cm.—are prevalent in western Pennsylvania and the glacial areas to the westward as well as in parts of Northwest Texas. Cast magnesium anodes have proved to be satisfactory in low-resistance soils.

A description of the steps taken to protect from high corrosion rates sections of the gas-distribution system operated by United Gas Corp., Houston, was presented in the paper, "The Mitigation of Corrosion on City Gas-Distribution Systems." In his discussion, A. D. Simpson, Jr., chief engineer of United Gas Corp., said some 19 tons of zinc, 8 tons of magnesium, and three rectifiers have been used in the project to protect parts of the system, some of which were installed in the period of 1925-1930. Over 1,000,000 ft. of lines were included in the project. In congested areas such as in the city of Houston galvanic anodes are preferred as the source of protective current. Rolled zinc plate of 99.9 per cent purity has been adopted as standard. Where possible zinc anodes are avoided in soils having resistivity higher than 2,500 ohms per cu. cm. When necessary to install galvanic anodes in high-resistance soils magnesium or its alloys is preferred.

J. P. Oliver in his paper, "The Value of Backfill With Carbon and Graphite Anodes," pointed out that these materials divert much of the electrochemical attack from the ground rod and that the graphite anode is more resistant to electrochemical attack than is the carbon anode. However, in the presence of bromides or fluorides carbon has been found preferable to graphite as an anode material unless current density is kept low. Concentrations of sulfates greater than normally encountered in soils accelerate attack on both carbon and graphite anodes.

Power Pipe Unique

Experiences with corrosion of an 11-mile, oil-filled pipe line for electrical power transmission were discussed in the paper, "Electrolysis Experiences on 115 kv. High-Pressure Oil-Filled Pipe-Type Cable Installation in New Orleans," by S. E. Trouard, New Orleans Public Service Co., Inc., New Orleans. The line, laid in 1946-1947 through the metropolitan area of the city, operates under a pressure of 200 psi. The pipe used for the installation was seamless, grade A, open-hearth steel, 6⅝-in. o.d. by ⅜-in. wall. Exterior coating of the pipe was applied at the mill as was an interior surfacing of rust inhibitor. For protection of the pipe in shipment all ends were capped. Coating on the line's exterior consists of a double thickness of plasticized special coal-tar enamel and double wrapping of coal-tar-impregnated asbestos felt. This type of protection was specified instead of the ordinary type because of the cable operating temperatures of 158° F.

W. R. Smith, chemist, Nukem Products Corp., Buffalo, discussed in his paper, "Preliminary Examination of Acid and Alkali Resistant Coatings," the various factors to be taken into consideration in selection of coatings. Smith outlined the general classification of various coatings and pointed out the preliminary considerations: handleability; acid and alkali resistance; surface preparation requirements; toxity of solvent vapors; effect on previous films; and sedimentation. Other factors discussed by Smith related to pigment dispersion, binders, solvents and accelerated aging tests of air drying coatings.

EQUIPMENT MEN ...in the News

Fluid Packed Pump Announces Appointments

G. PETERS

Sidney Shuman, general sales manager, Fluid Packed Pump Co., announces appointment of Glen Peters as assistant sales manager for the Mid-Continent, Gulf Coast, Rocky Mountain, and Eastern area with headquarters at Oklahoma City. Peters is a veteran oil man who has served Fluid Packed Pump Co. in various capacities since 1941.

Jack Hampton, formerly a California salesman for the company, has reentered the company's employ as factory representative for Mississippi with headquarters at Laurel.

Charles Cameron, pump salesman in California, Montana, and Oklahoma, has been appointed Arkansas factory representative for the company with headquarters at Eldorado.

West To Manage Industrial Sales

Ray R. West has been named manager of sales of Minneapolis-Honeywell Regulator Co. products for industrial applications.

West's appointment is in line with current Honeywell sales expansion and new products developments for control of temperature, humidity, and pressure in industrial and specialized fields. West, who has filled executive sales positions with Brown Instrument during his more than 20 years with the industrial division of Honeywell, will make his headquarters at the Brown plant in Philadelphia.

Homco to Represent Rochester Rope

Houston Oil Field Material Co., Inc., will be distributor for Rochester wire ropes throughout the oil country.

Homco, which has 24 stores in Louisiana, Mississippi, New Mexico, Oklahoma, and Texas, will handle Rochester rope at every outlet. The complete Rochester line will be available, including Rochester "Wirelon," the nylon-covered wire rope recently introduced by the Rochester company.

Engineering service on oil-country wire-rope applications will be available both through Homco and Rochester wire-rope engineers.

Rochester Ropes, Inc., is well known as a manufacturer of quality cables, with plant and main offices in Culpeper, Va., and other offices and warehouses in Birmingham, Chicago, Houston, New York, and San Francisco.

Homco is one of the foremost oilfield-supply companies. Founded in 1928 to supply specialty items and equipment for cutting and fishing operations, it has grown from 1 store to the 24 it now has in this country, together with representation in Caracas, Venezuela.

Smith Oil Tool Promotes Two

LEIDECKER

WOMACK

Lew Leidecker, formerly branch manager of H. C. Smith Oil Tool Co. at Craig, Colo., has been moved up to division manager for Michigan and the tristate area. He makes his headquarters at Carmi, Ill. Leidecker joined the company in 1945.

John Womack has been appointed division manager for Wyoming and will maintain headquarters at Douglas. For the past year he has been assistant branch manager at Vernal, Utah.

New Dallas Office for Cutler-Hammer

Announcement is made by Cutler-Hammer, Inc., Milwaukee, of new and expanded quarters for the company's Dallas district sales office and warehouse.

Located at 1331 Dragon Street, in the Trinity industrial district, the new quarters provide improved facilities for the sale and distribution of Cutler-Hammer motor control and allied electrical products in the Dallas area. E. K. Anderson is Dallas district manager for Cutler-Hammer.

Merchandising Department Formed by Regulator Firm

Formation of a new department of the Minneapolis-Honeywell Regulator Co. to supervise and coordinate the advertising, merchandising, and sales promotion activities of the company has been announced by C. B. Sweatt, executive vice president.

John R. Bergan has been appointed head of the new department as merchandising manager. Other changes include the promotion of Chandler Murphy as advertising manager and John A. Young as sales promotion manager. Murphy succeeds William B. Walrath who has resigned to join the Chicago advertising staff of Fortune magazine.

Westinghouse Names Monteith Vice President

A. C. Monteith, 46-year-old engineering executive of the Westinghouse Electric Corp., Pittsburgh, has been elected vice president in charge of engineering and research, Gwilym A. Price, Westinghouse president, announces. He succeeds Marvin W. Smith, who was elected executive vice president of Baldwin Locomotive Works.

Johnston on Texas Trip

M. O. JOHNSTON

M. O. Johnston, president of Johnston Oil Field Service Corp. and Johnston Enterprises, recently made a business trip by plane from the company's Los Angeles plant to various points in Texas. At Longview he conferred with his partner in Johnston Enterprises, E. C. Johnston, about Hydra-Line developments. He also spent some time with Manager Bill Taylor of the Johnston Oil Field Service Corp. at its Houston headquarters.

Smith Succeeds Bates

Frank J. Smith has been appointed advertising and sales promotion manager of Philip Carey Manufacturing Co., Cincinnati. Frank Smith succeeds Harold D. Bates, who was recently promoted to general merchandise manager.

Mud Products Divided Into Three Divisions

Mud Products, Inc., Tulsa, recently announced the organization of three separate divisions, according to the firm's general manager, E. R. "Dick" Albert, Jr.

The three new divisions of the company will include the mud sales division, handling mud and chemicals only, the mud-equipment division, selling and servicing mud-handling equipment exclusively, and the export division, which will handle the sales and service of both mud and equipment in foreign countries.

Mud Products, Inc., now has 12 modernized warehouses in the Mid-Continent area, and operates a large fleet of supply trucks on duty 24 hours a day. In conjunction with its supply service, mud-equipment engineers are available to offer counsel and engineering advice on mud-equipment problems.

Rockwell Appoints New Chief Engineer

Rockwell Manufacturing Co. has appointed E. E. Hedene as chief engineer of all operations of Nordstrom Valve Division. He was formerly the chief engineer of the Nordstrom Valve plant at Oakland, where for the major part of his 22 years' service he worked directly with Sven Nordstrom, the inventor and developer of Nordstrom lubricated plug valve.

Hedene will be headquartered at the company's general office at Pittsburgh. His duties will include considerable field work in addition to coordinating Nordstrom engineering activities at the Pittsburgh, Hopewell, Oakland, and East Chicago plants.

Hedene is a member of the American Society for Metals and is a member of the following A.P.I. committees: Manufacturers Standardization Committee for Valves and Fittings, Petroleum Equipment Committee of Manufacturers Standardization Society, and the Subcommittee of Cast Stainless Steel Valves of M.M.S.

Design Division Formed

United Engineers & Constructors, 1401 Arch Street, Philadelphia, announces the organization of a chemical engineering and process design division to complement the general engineering services of the company. The company is prepared to serve the chemical and process industries with a completely integrated engineering and construction organization from the basic studies and flow sheets to the completed plant.

Gerald L. Eaton, Gordon J. Robertson, and Thomas G. Reynolds are the senior process engineers; E. A. Adler is responsible for instrumentation and A. J. Erlacher for vessel design and work with ferrous and nonferrous metals. These men have each had a wide experience in their respective fields.

Williams Promoted to Western Division

L. E. WILLIAMS

Buda Engine Sales & Service of Tulsa announces the promotion of Loyd E. Williams to manager of the company's western division which embraces Colorado, Wyoming, and Montana. Williams has been successively manager of the company's Salem, Ill., and Denver branches. He will continue to reside in Denver but will divide his time between Casper and Denver.

Other organizational promotions include Art Holt from the Denver store to Casper as manager, Ben Culley from the Seminole store to Casper as sales engineer, and Henry Postlethwaite from the Great Bend store to Denver as sales engineer.

Horton Establishes Tulsa Engineering Service

C. R. Horton has resigned as chief engineer and general manager of Macnick Co., Tulsa, and established a consulting engineering service at Tulsa devoted to product development. His private practice will afford those entering or growing into a new item field assistance in bringing new developments to a successful production stage.

Horton joined the Macnick organization in July 1932 as tool designer and was later made chief engineer. As operations of the plant increased he was given the additional responsibility of superintendent of manufacturing in 1936. He was made general manager in 1939. Prior to joining Macnick he had been in industrial specialty sales; inspection of turnkey gasoline-plant fabrication for Jackson Engineering; and earlier was equipment project engineer for Western Electric Co., Chicago.

Ethyl Corp. Makes Appointments

R. F. WILLIAMS

Rudy F. Williams has been named superintendent of terminals to direct the operations of Ethyl Corp.'s new storage terminal plants located at Edge Moor, Del., and Wilmington, Calif. Both terminals are now delivering tank truck and drum shipments of Ethyl antiknock compound to customer oil companies in their respective territories.

Other appointments in connection with the company's new delivery service from storage terminals are those of Charles D. Remsburg as supervisor of the terminal at Edge Moor, and of Clarence H. Johnson as supervisor at Wilmington.

Kidde Expands Caribbean Sales

A. C. Dehnel of the export department, Walter Kidde & Co., Inc., Belleville, N. J., has returned from a 6-week trip to countries in the Caribbean area, where he held a series of fire-fighting demonstrations for representatives of the petroleum, power, and allied industries.

Dehnel visited Puerto Rico, Haiti, Dominican Republic, Colombia, Panama, the island of Aruba, and Venezuela. He spent 3 weeks in Venezuela with petroleum engineers instructing them in the use of Kidde fire-extinguishing equipment.

As a result of Dehnel's trip, new agents for Kidde fire protection equipment have been appointed in Haiti and Panama. This completes the Caribbean network of Kidde sales and service agencies in every Central American country, with the exception of Nicaragua and Costa Rica.

Koppers Forms New Section

The Engineering & Construction Division of Koppers Co., Inc., has set up a new chemical section to supervise and coordinate engineering and construction work on contracts secured for the erection of plants to produce oxygen, synthetic fuels, and certain types of chemicals, it is announced by Joseph Becker, vice president.

Heading up the new section will be T. M. Osborne, who has been project manager on Koppers' contract to build a $4,500,000 synthetic-liquid-fuels plant for the Government at Louisiana, Mo.

The new section will have general responsibility for all contracts to build oxygen plants and synthetic-liquid-fuels plants, as well as contracts for

chemical plants which are not directly associated with coke oven and steel plants.

Byron Jackson Promotes Shira to New Post

R. W. SHIRA

J. C. Ballagh, vice president, Byron Jackson Co., and general manager of Patterson-Ballagh Division, recently announced the promotion of R. W. (Bob) Shira to assistant export manager, under Earl Rees, export manager.

Shira was formerly in the service division at Patterson-Ballagh, later becoming advertising manager, in which capacity he served for over a year. He then joined the California sales division in Los Angeles.

Peerless Pump Completes Plant Removal

Movement of both personnel and equipment into the new 19-acre plant site at Indianapolis has been completed by Peerless Pump Division of Food Machinery Corp., according to F. E. Fairman, Jr., vice president of Food Machinery Corp. and general manager of its Peerless Pump Division.

Peerless' new Indianapolis plant is the former Fall Creek ordnance works and was acquired from the War Assets Administration late in 1946 with a bid of $861,000. Construction features of the existing Fall Creek plant are well adapted to the problem of manufacturing high volume of pump units.

Works manager of the Peerless Indianapolis plant is H. J. McKenzie; assistant works manager is C. N. Adams. The plant is producing units of the complete line of Peerless pumps, vertical, horizontal centrifugal, and domestic water systems. Other departments now located at the plant include the centrifugal - sales section and the small-products sales section, plus a complete designing and engineering staff, supplemented by accounting and credit personnel.

Metal Goods Elects Gregg

Harris T. Gregg, manager of the Houston branch of Metal Goods Corp. has been elected to a vice presidency of the company.

Metal Goods Corp., with offices and warehouses in St. Louis, Kansas City, Tulsa, Denver, New Orleans, Dallas, and Houston, is an important supplier of aluminum, brass, copper, Monel, nickel, stainless-steel, and clad-steel products to Southwestern industry.

Rogers Named to Hughes Board

Fred W. Ayers, senior vice president and managing director of Hughes Tool Co., Houston, announces the naming of Harry E. Rogers, vice president, as a member of the board of directors of the company. Rogers has been with Hughes since 1945, since which time he has been promoted from manager of production to vice president in charge of manufacturing.

Persons Made St. Louis District Manager

R. L. Persons has been named district manager of the St. Louis territory for Penn Electric Switch Co., according to R. H. Luscombe, general sales manager. He replaces O. G. Tinkey, former manager.

Persons was assistant sales manager of a division of McQuay-Norris Manufacturing Co. of St. Louis. Previously he held a similar position with L. M. Persons Corp. of the same city.

Ansul Elects Officers

F. J. HOOD

F. J. "Jim" Hood has been elected president of Ansul Chemical Co., Marinette, Wis. He succeeds Harvey V. Higley, who has been named chairman of the board of directors.

Hood joined Ansul's California office in 1928. He worked in sales for 8 years, returning to Marinette in 1936. In 1938 he was elected secretary and treasurer. He was promoted to vice president in 1945.

Other officers elected are R. C. Hood, vice president, H. C. Higley, secretary, J. F. Asell, treasurer, and S. R. Holmquist, comptroller and assistant treasurer.

Schlumberger Officials Attend Conference

Roger Henquet and Bob Ford, of Schlumberger Well Surveying Corp., Houston, flew to London on August 23 as Schlumberger delegates to the International Geological Conference.

Pelton Men Hold Lecture

Shell Oil Co., Inc.'s, southern division in California heard a 3-hour lecture on the Pelton hydraulic pumping jack recently at Shell headquarters in Long Beach. D. K. Stewart, Shell district production foreman, and Shell engineers arranged the lecture in cooperation with Pelton. The talk was attended by approximately 40 production foremen, engineers, maintenance and operating personnel of the Shell organization.

C. J. Woodard, manager sales-service of the Pelton hydraulic pumping jack department, and Clyde H. Lietzow, Pelton's sales-service engineer in Long Beach, instructed the Shell personnel in the operation of the Pelton jack.

Cragin Appointed Vice President

Refinery Maintenance Co., Inc., Compton, Calif., and Houston, announces the appointment of Robert B. Cragin as vice president. This move is in line with further expansion of the company as designers, engineers, and constructors for the petroleum-refining, natural-gasoline, and petrochemical industries. Announcement was made by F. J. Buckner, president.

Cragin served as a vice president of Houdry Process Corp. from 1944 until his resignation in March of this year. Prior to this he served as assistant director of refining division, Petroleum Administration for War in Washington during the war years. He was employed by M. W. Kellogg Co. as process and sales engineer from the time of his graduation from Princeton until his government services.

Theimer Opens Gulf Coast Office

Manning, Maxwell & Moore, Inc., Bridgeport, Conn., and Tulsa, have announced the opening of a Gulf Coast district with sales offices in Houston. The district will include Texas, Southeast New Mexico, southern Louisiana, and southern Mississippi. George M. Theimer, formerly Mid-Continent district manager in Tulsa, will be manager of the new district.

Theimer will be succeeded in Tulsa by Ray C. West. The Mid-Continent district of the company includes all or part of Oklahoma, Mississippi, Louisiana, Arkansas, Missouri, Kansas, New Mexico, Colorado, and Wyoming.

Chain Belt Appoints Breith

Chain Belt Co., Milwaukee, announces the opening of a district sales office at Midland, Tex.

Dave Breith, newly associated with Chain Belt Co., will be in charge of the office. He is a graduate of Texas A. & M. and has had extensive experience in the Texas oil fields in the employ of Continental Oil Co., Bethlehem Supply Co., and General Oil Service, Inc.

(Continued on page 366)

Classified Advertising

The Market Place for the Oil Industry

UNDISPLAYED

All ads, 12 cents a word. Minimum charge, $3.00 per insertion.
Centered Line, any ad, $1.00.
Box Numbers count 9 words when replies are to be sent to our Tulsa Office. Replies forwarded without charge.

DISPLAYED, PER INCH

$12.00 per column inch per insertion. One-point border and 12-point capitals are allowed. Larger type sizes not accepted.

All classified advertising payable in advance.
10% Discount if 3 insertions are ordered at one time.
COPY DEADLINE, 9:00 a.m. Monday prior to each week's issue.

THE OIL AND GAS JOURNAL
P. O. Box 1260, TULSA, OKLAHOMA

EQUIPMENT FOR SALE

FOR SALE: Bucyrus-Erie 24-L Trailer mounted spudder with casing reel, clutch driven sand reel, cat heads complete with cables and 6", 8" and 10" Tools, joints 3¾ and 4¼. Water pump, light plant, set sectional A shear poles with blocks. $6500.00 Cash F.O.B. Princeton, Indiana. A. H. Bigler, Phones 219 or 494.

PIPE FOR SALE: 2000′ of 20 lb. and 2000′ of 17 lb. 6⅝" I.D. casing. Take all at $2.25 per foot. 312′ of 8" I.D. 28 lb. @ $3.00 per foot. Would trade for 4⅞ or 6¼ casing. Boyer Oil Co., Box #35, Iola, Kansas.

FOR SALE

No. 83 Speed Star Spudder, Mounted full trailer on hard rubber wheels, 4000′ drilling and sand lines, complete tailing-in tools, dog house, Kohler light plant, etc. Very portable, good condition.

W. R. BOWMAN
214 Kennedy Bldg. Phone 7-3018 or 2-2633
Tulsa, Oklahoma

SHOT HOLE DRILLS
LARGE AND SMALL

All are truck mounted, rotary, chain pull down, smallest pump size 3½ x 5. Some are in excellent condition, others need repairs. Price FOB Dallas from $3,000.00 to $8,000.00 including truck. For details write 8800 Lemmon Ave., Dallas 9, Texas.

WE BUY and SELL

Steel Pipe and Tubing
Pipe Fittings—Well Casing
Culverts and Valves

SONKEN-GALAMBA CORP.
2nd & Riverview, Kansas City 18, Kans.

EQUIPMENT FOR SALE

FOR CABLE TOOLS
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

FOR SALE. Wilson Master Model Winch powered by 6 MZR Waukesha engine. Unit mounted on one and one-half ton Chevrolet truck equipped with fifty foot single pole telescoping mast. Terms. Melton Supply Company, Seminole, Oklahoma.

USED Le Roi 6-, 8-, and 12-cylinder gas engines, complete and in A-1 condition for oil industry power. Priced to sell. Also one Model NKU Waukesha $1500. Write or call today. General Machine & Supply Company, P. O. Box 72, Wichita Falls, Texas.

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FOR SALE: Brand new 1948 Bucyrus Erie 36-L, trailer mounted, latest model, has never turned a wheel. 15" to 5½" tools; Wilson elevators; new 4 cylinder light plant; new blower and forge; 100′ of 12" pipe, 900′ of 10", 1700′ of 7"; 1900′ of 5½", all seamless; 8 round thread; new ⅞ drilling line; new ¾ sand line; casing spider—fishing tools. G. W. Miller, 706 Cherry St., Mt. Carmel, Ill., Telephone 166-J.

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Ada, Oklahoma

EQUIPMENT FOR SALE

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All Plain End, Lapweld, 20 ft. random lengths. Suitable low pressure oil, water, or gas lines.

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FOR SALE: Wilson Mogul draw works, powered by G.A.K. Waukesha engine. Good condition, priced for quick sale. Terms. Melton Supply Company, Seminole, Oklahoma.

FOR SALE: Wilson Super Model Winch powered by 6 MZR Waukesha engine. Terms. Melton Supply Company, Seminole, Oklahoma.

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1—PDM 46 Emsco Drilling Unit Powered with Two (2) D 17000 Caterpillar Diesel Engines, 7¼" x 14" Gardner-Denver Power Pump, Type H Emsco Reverse Clutch, B 6 Emsco Swivel, 54" 4 Sheave Emsco Traveling Block, N 15 Emsco Oil Bath Rotary Table, Y 15—5 KW Light Plant, 7' x 12' American Steel Tool House, 87' Lee C. Moore Cantilever Jackknife Mast, complete with tools, fittings, tongs, slips, elevators, etc., less drill pipe and drill collars. Located Western Kansas, priced to sell—$28,500.00 F.O.B. Location. Inventory and location upon request. H. A. McCarthy, 310 Thompson Bldg., Tulsa, Oklahoma. Phone 5-3296.

DIESEL, GMC TRUCK, 1942, Model ADC 905: Mileage 1,650; camel-back steel platform with winch. Johnson & Miller Trading Co., 10-07 50th Ave., Long Island City 1, N. Y.

FOR SALE: Model 55 Wichita Falls Spudder with telescoping steel mast; steel tool house and tools for 7" hole; powered with LeRoi motor in excellent shape. $5500.00 at present location. Box C-583, care The Oil and Gas Journal, Tulsa, Oklahoma.

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1—Complete set of seismograph equipment. Immediate delivery and ready for field operations. Contact Mr. Patridge, Cities Service Oil Co., Bartlesville, Okla.

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FOR SALE at our Seminole, Okla., Production Camp—1 Used Allis Chalmers Model UEL Skid Servicing Winch, Single Drum, driven by E60 and mounted on C40-F Int. 186" Wheelbase Tandem Drive Truck. Both new March 1937. No tools or mast. $2500. Cities Service Oil Co., Patridge, Bartlesville, Okla.

FOR SALE at our Seminole, Okla., Production Camp: 1—Used Cardwell Model KS-DHS Single Drum Skid Well Servicing Winch bought new 1935, Driven Through Jack Shaft by DHK Waukesha Motor and Mounted on GMC '37 Model, 178" Wheelbase Truck. No tools or mast. $2500. Cities Service Oil Co., Patridge, Bartlesville, Okla.

FOR SALE—One #45 Heavy Duty Fort Worth Spudder complete with tools to drill 5,000' hole. Write Joseph J. Snyder, 209 Stewart St., Carmi, Illinois.

FOR SALE: 4½" second-hand rotary drill pipe; 4½" drill pipe made into casing; 4½" drill pipe for line pipe. Box 476, Great Bend, Kansas.

FOR SALE: One late model Cleveland Trencher with 14-in. buckets. Price $9,000.00. Phone 2-4261, Oklahoma City, Oklahoma.

FOR SALE: Two No. 2 National Drilling machines, complete with tools and Riise motors. Call or write C. J. Hughes, Phone 1983, Box 1151, Logan, West Va.

WE have available oil well casing, line piping, upset tubing. Allied Sales Company, 507 Market Street, San Francisco. Wire—write—phone Yukon 6-3864.

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FOR SALE: Three (used) Bessemer Gas Engines—Type X—165 H.P. Compressor Cylinders 18⅛ x 20 & 16¼" x 20"; Four Watts Miller Gas Engines 225 H.P. Twin Hor. 19" x 24" Power Cylinders—18 & 16" x 24" Comp Cylinders; Twenty-four—Clark Single Engines Driven Compressors-Units Power Cyl. 16" Compressor Cylinders, various sizes, 15"-16" & 7¼". All units in Oklahoma City. Contact: Emco Equipment Co., 1334 First Nat'l Bld'g, Oklahoma City, Phone 7-6607.

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EQUIPMENT WANTED

WANTED

96′ or 97′ Lee C. Moore Cantilever Mast. B & B Drilling Company, Box 309, Pauls Valley, Oklahoma.

WANTED: Used Cross Reaction Chamber. Approximately 5′ OD x 44′ long. State price, condition, location, enclose sketch. Box C-422, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED MAGNETOMETER: Good used light reconnaissance type temperature compensated vertical magnetic field balance. Box C-610, The Oil and Gas Journal, Tulsa, Oklahoma.

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Experienced graduate petroleum engineer to supervise field operations with production department of independent refinery on Texas Gulf coast. Must be between 28 and 35 years of age. Must have thorough understanding of drilling, well completion, and relative production problems. In reply submit complete education and experience record stating salary expected.

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PETROLEUM GEOLOGIST — Aggressive, independent company has position available in Tulsa for graduate geologist experienced in Mid-Continent area and qualified to handle property reserve estimates. Letter of application should include personal facts, complete experience record, references and salary expected. Address Box C-606, The Oil and Gas Journal, Tulsa, Oklahoma.

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